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NATIONAL DAM SAFETY PROGRAM. NODAWAY LAKE DAM (MO 10178) LOWER --ETC(U)
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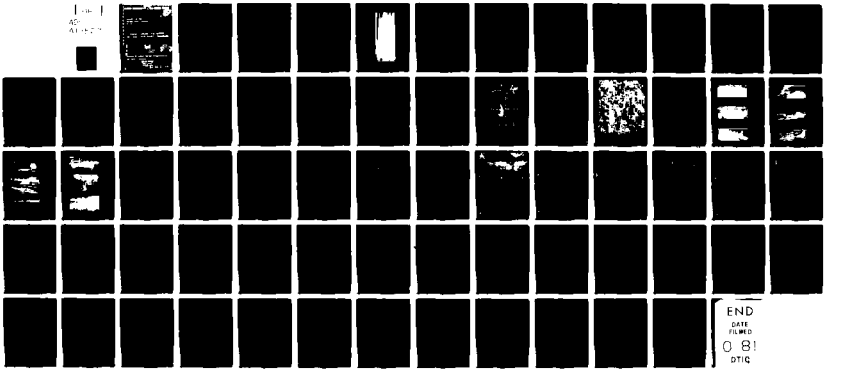

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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REPORT DOCUMENTATION PAGE

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	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Phase I Dam Inspection Report National Dam Safety Program Nodaway Lake Dam (MO 10178) Nodaway County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report.
	6. PERFORMING ORG. REPORT NUMBER
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11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	12. REPORT DATE August 1978
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Approved for release; distribution unlimited.

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18. SUPPLEMENTARY NOTES

National Dam Safety Program. Nodaway Lake Dam (MO 10178) Lower Mississippi - 102 River Basin, Nodaway County, Missouri. Phase I Inspection Report.

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

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PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Nodaway Lake Dam
State Located	Missouri
County Located	Nodaway County
Stream	Tributary to Canal Branch One Hundred and Two River
Date of Inspection	July 12, 1978

Nodaway Lake Dam was inspected by an interdisciplinary team of engineers from Hoskins-Western-Sonderegger, Inc. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as an intermediate size dam with a high downstream hazard potential. Failure would threaten the life and property at four farmsteads located within the first two miles downstream of the dam and would also cause appreciable damage to four improved road crossings. The estimated damage zone extends eight miles downstream of the dam.

Our inspection and evaluation indicates that the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The spillway will pass 0.48 of the Probable Maximum Flood without overtopping the dam. An additional deficiency, in accordance with the guidelines, is the lack of seepage analysis. These analyses should be obtained in the future.

Other deficiencies visually observed by the inspection team were small trees growing on the upstream embankment slope, some deterioration of the limestone riprap, and dense growth of trees and brush in the channel downstream from the principal spillway.

Several items of preventive maintenance need to be initiated by the owner. These are described in detail in the body of the report. Copies of the report have been furnished the dam owner and the Governor of Missouri.

H. P. Hoskins

Harold P. Hoskins, P.E.
Hoskins-Western-Sonderegger, Inc.
Lincoln, Nebraska

SUBMITTED BY SIGNED — 1 SEP 1978
Chief, Engineering Division — Date

APPROVED BY SIGNED — 1 SEP 19[illegible]
Colonel, CE, District Engineer — Date

PHOTO NO. 1
OVERVIEW OF LAKE AND DAM
TAKEN FROM ENTRANCE TO
PARKING AREA LOOKING SOUTHWEST.
DAM IS LOCATED AT LEFT
CENTER OF PHOTOGRAPH

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NODAWAY LAKE DAM - ID NO. MO 10178

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SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection of the Nodaway Lake Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) Nodaway Lake Dam is an earth fill approximately 1480 feet in length with maximum height of about 57 feet. Topography adjacent to the dam is gently rolling. Soils on the lower slopes are apparently derived from fine grained glacial till. Upland soils appear to be loessial in origin.

(2) The primary or principal spillway consists of a reinforced concrete riser with a 30 inch diameter reinforced concrete pipe conduit outlet.

(3) The emergency spillway is cut into glacial till on the left (east) abutment. It has a bottom width of 40 feet and side slopes of 3H on 1V.

b. Location. The dam is located in the north central portion of Nodaway County, Missouri, as shown on Plate 2. The lake formed by the dam is shown on Plate 1 in the NE 1/4 of Section 20, T65N, R35W and the SE 1/4 of Section 17, T65N, R35W. The lake is also shown on the Maryville NE Orthophotograph (Plate 3).

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, this dam and impoundment is in the intermediate size category.

d. Hazard Classification. Guidelines for determining hazard classification are presented in the same guidelines as referenced in paragraph c above. Based on referenced guidelines, this dam is in the High Hazard Classification. The estimated damage zone extends eight miles downstream of the dam. Within the first two miles downstream of the dam are four farmhouses with associated farm buildings and four improved road crossings.

e. Ownership. The dam is owned by the Missouri Department of Conservation.

f. Purpose of Dam. The dam forms a 70 ± acre recreational lake and provides flood retardation for the 100-year frequency rainfall event.

g. Design and Construction History. The dam was constructed in 1966. The design and the plans for construction were prepared by the Soil Conservation Service (SCS), Columbia, Missouri. Portions of these plans are included with this report as Appendix C.

h. Normal Operating Procedure. Normal rainfall, runoff, transpiration and evaporation all combine to maintain a relatively stable water surface elevation. Information was not available relative to flow through the emergency spillway.

1.3 PERTINENT DATA

a. Drainage Area - 730 acres.

b. Discharge at Damsite.

(1) All discharge at the damsite is through an uncontrolled reinforced concrete drop inlet pipe principal spillway and a grassed earth channel ungated emergency spillway.

(2) Estimated maximum flood at damsite - unknown.

(3) The principal spillway capacity varies from 0 c.f.s. at elevation (1083.0) to 129 c.f.s. at the crest of the emergency spillway (1086.0).

(4) The principal spillway capacity at maximum pool elevation (1087.3) is 131 c.f.s. Maximum pool elevation is that design value for freeboard pool level as furnished on SCS as-built plans.

(5) The emergency spillway capacity at maximum pool elevation is 141 c.f.s.

(6) The total spillway capacity at maximum pool elevation is 272 c.f.s.

c. Elevation (Feet Above M.S.L.).

(1) Top of dam - 1089.0 (SCS plans) - 1089.3 (survey 12 July 1978).

(2) Principal spillway crest - 1083.

(3) Emergency spillway crest - 1086.

(4) Streambed at centerline of dam - 1037±.

(5) Maximum tailwater - unknown.

d. Reservoir. Length of maximum pool - 3700 feet ±.

e. Storage (Acre-feet). Top of dam - 2140.

f. Reservoir Surface (Acres).

(1) Top of dam - 80 acres ±.

(2) Spillway crest - 70 acres ±.

g. Dam.

(1) Type - earth embankment.

(2) Length - 1480 feet ±.

(3) Height - 57 feet ± maximum, 52± at centerline.

(4) Top width - 18 feet.

(5) Side Slopes -

(a) Downstream - 2.5H on 1V down to a 15 foot wide berm and 4H on 1V below the berm.

(b) Upstream - 3H on 1V with 10 foot and 30 foot wide berms.

(6) Zoning - none shown on plans.

(7) Impervious core - none shown on plans but all embankment material reported to be clay (CL) as shown in Appendix C.

(8) Cutoff - Plans show cutoff varying in depth from 5 to 15 feet with 10 foot bottom width and side slopes of 1H on 1V.

(9) Grout Curtain - none.

(10) Drains - Plans show foundation drain approximately 5 feet in depth extending from about ℄ station 6+30 to station 11+10 (stationing according to plans).

h. Diversion and Regulating Tunnel. None.

i. Spillway.

(1) Principal.

(a) Type - standard SCS reinforced concrete with drop inlet and a 30 inch reinforced concrete pressure pipe.

(b) Length of weir - 19 feet.

(c) Crest elevation - 1083.0 feet m.s.l.

(2) Emergency.

(a) Type - standard SCS grassed earth channel.

(b) Control section - 40 foot bottom width 3:1 side slopes.

(c) Crest elevation - 1086.0 feet m.s.l.

(d) Upstream channel - clear and well grassed.

(e) Downstream channel - badly blocked with trees and brush which could affect tailwater conditions on principal spillway discharge.

j. Regulating Outlets.

(1) Principal spillway.

(a) 24" diameter gated port (elevation 1075.0 invert).

(b) 16" diameter ASA Class 125 valve (elevation 1053.56) from as-built plans.

(2) Emergency spillway - None.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Data on the geologic investigation, hydraulic/hydrologic computations, construction plans, and the soil mechanics/soil engineering report were supplied by the Soil Conservation Service, Columbia, Missouri. This information is shown in Appendix C and Appendix D.

2.2 CONSTRUCTION

No construction data were readily available; however, it is reported that the dam was constructed with SCS engineering supervision and standard inspection and quality control procedures.

2.3 OPERATION

No information was available on the maximum loading on the dam.

All spillways are uncontrolled.

No information available on operation of discharge system.

2.4 EVALUATION

a. Availability. The engineering data shown in Appendix C was readily available from the SCS, Columbia, Missouri.

b. Adequacy. The available data and reported information are adequate to assess the design and stability of the structure.

c. Validity. The available data and analyses conform with accepted practice.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Nodaway Lake Dam was made on July 12, 1978. Personnel making the inspection are employees of Hoskins-Western-Sonderegger, Inc., Lincoln, Nebraska, and included Garold Ulmer, civil engineer; Richard Walker, Hydrology, and Rey S. Decker, Soil Mechanics and Geology.

Results of the visual inspection are summarized below. Photographs are shown in Appendix B.

b. Dam. Rough measurements of the profile along the crest of the dam and emergency spillway centerline and cross-sections of the embankment and spillway indicate that the dam was constructed according to the plans shown in Appendix C.

The dam is covered with an excellent growth of adapted grasses and legumes.

A few small trees were observed along the upstream face. Riprap on the upstream slope extended 3 to 4 feet above the water surface. The riprap consists of a rather poor grade of thin bedded limestone and some deterioration was noted. No significant erosion was noted on the upstream slope.

Surface materials in the dam consist of lean to fat clays (CL or CH).

There was no indication of emergence of the phreatic line or other seepage on the downstream slope or along the toe of the dam.

The foundation drain was discharging clear effluent at the rate of approximately 1 gal/min. A few small seeps were observed around the left (looking downstream) side of the principal spillway stilling basin or plunge pool. These seeps extended up the plunge pool slopes about 3 feet above the water surface and emerged through CL material. The very small discharge from these seeps was clear.

No cracks, slides, or abnormal deformations were observed in the embankment.

c. Appurtenant Structures.

(1) Principal Spillway - There were no indications of spalling or deterioration of the principal spillway riser nor the concrete pipe outlet. The lake level was at the spillway crest elevation at the time of the inspection.

(2) Emergency Spillway - The emergency spillway is well vegetated with adapted grasses. It looked very good with no evidence of erosion in the bottom or side slopes.

(3) Drawdown Facility - The plans show a 30 inch R/C pipe entering the base of the principal spillway riser. Flow through this system is controlled by a 16 inch valve at the base of the riser and a 24 inch slide headgate near the top of the riser (see sheet 6 of 22 of the plans). This system is designed as a drawdown facility to evacuate the reservoir. It is not known whether or not the gates and valves are operable.

d. Reservoir Area. No wave wash, excessive erosion or slides were observed along the shore of the reservoir. The east shoreline was riprapped for a distance of 1200 to 1300 feet upstream from the dam.

e. Downstream Channel. The channel downstream from the principal spillway is badly clogged with trees and brush.

f. Other. There is an old gully plug or small farm pond about 150 feet downstream from the toe of the dam opposite about centerline station 4+50 (stationing as shown on the plans). The pond was dry at the time of the inspection.

3.2 EVALUATION

None of the conditions observed indicate a need for immediate remedial action. Trees on the upstream slope of the dam, trees and brush in the downstream channel, and slight deterioration of the riprap are deficiencies which could ultimately impair the integrity of the dam if left uncontrolled or uncorrected.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The pool level is normally controlled by rainfall, runoff, evaporation and capacity of the uncontrolled spillways. Procedures for operating the drawdown facility are not known.

4.2 MAINTENANCE OF DAM

The dam is reasonably well maintained. Action should be taken to correct the minor deficiencies noted in Sections 3 and 7.2.

4.3 MAINTENANCE OF OPERATING FACILITIES

It is not known if the drawdown facility is operable nor if and when the system has been operated.

4.4 DESCRIPTION OF WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION

The dam and appurtenances appear to be well maintained with the exception of some laxity in controlling tree growth on the upstream face and allowing a few sections of the riprap wave protection to deteriorate.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. Pertinent hydraulic and hydrologic data which were taken from as-built plans furnished by the SCS are tabulated in Appendix D on Hydrologic Computations. The supporting computations are attached.

b. Experience. The drainage area and lake surface area are developed from USGS Maryville Quadrangle and orthophoto sheets. The spillway and dam layout are from as-built plans and surveys made during inspection. There were no major discrepancies discovered as far as the hydraulic structural components of the dam and spillway were concerned.

c. Visual Observations.

(1) Principal and emergency spillways are in good condition except as noted.

(2) The emergency spillway does not appear to have ever been used.

(3) The emergency spillway and exit channel are in the left hillside abutment away from the dam. Spillway releases will not endanger the integrity of the dam.

d. Overtopping Potential. The spillways are too small to pass the probable maximum flood without overtopping. One-half the PMF will overtop the dam by 0.24' for a period of 3.0 hours. The spillways will pass the 0.48 PMF without overtopping. The existing spillways will pass the 100-year frequency flood without overtopping. The results of the routings through the dam are tabulated in regards to the following conditions.

Frequency	Inflow Discharge c.f.s.	Outflow Discharge c.f.s.	Maximum Pool Elevation	Freeboard Top of Dam Min. Elev. 1089.3	Time Dam Overtopping Hr.
100 Yr.	2239*	131*	1085.95*	+3.35	0
1/2 PMF	3380	1014	1089.54	-0.24	3.00
PMF	6802	6190	1091.11	-1.80	4.25
0.48 PMF	3000	800	1089.3	0	0

*Data taken from SCS as-built plans

According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, this dam is classified as having a high hazard rating and an intermediate size. Therefore, the PMF is the test for the adequacy of the dam and its spillways.

The St. Louis District, Corps of Engineers, in a letter dated 13 July, 1978 has estimated the damage zone as extending eight miles downstream from the dam. Within the first two miles downstream are four farmhouses with associated farm buildings and four improved road crossings. This fact was verified by field inspection.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Maintenance features that could affect the long time safety of the dam are discussed in Section 3.2.

Hydraulic/Hydrologic analyses presented in Section 5 indicate that the dam will be overtopped by the probable maximum flood. Under those conditions, water would flow over the top of the dam to a depth of 1.8 feet ± for about 4.25 hours.

b. Design and Construction Data. The engineering data, analyses, and plans supplied by the SCS conform with accepted practice and are considered adequate to assess the structural stability of the dam.

There is no reason to question the adequacy of construction supervision and quality control.

c. Operating Records. There are no appurtenant structures that require operational functions.

d. Post Construction Changes. The inspection party is not aware of any post construction changes.

e. Seismic Stability. This dam is located in the Zone 1 seismic probability classification area. An earthquake of this magnitude is not expected to cause structural failure of this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. The few deficiencies in maintenance that were observed, a few small trees and minor deterioration of the riprap on the upstream slope, should be corrected and/or controlled. The probable maximum flood (PMF) will overtop the dam, however, the spillways are adequate to pass the flood resulting from the 0.48 PMF without overtopping. The dam is designed to impound the flood resulting from the storm that has a 1 percent (1 in 100 years) chance of occurrence without flow in the emergency spillway.

b. Adequacy of Information. The information presented in this report is considered adequate to assess the safety of the structure. Seepage analyses were not found, which is a deficiency that should be corrected in the future.

c. Urgency. There is no immediate urgency to accomplish the remedial measures discussed in paragraph 7.2.

d. Necessity for Phase II. Based on the results of the Phase I inspection, Phase II investigations are not considered necessary.

e. Seismic Stability. The dam is located in Seismic Zone 1. An earthquake of this magnitude is not expected to be hazardous to this dam.

7.2 REMEDIAL MEASURES

a. Alternatives. The size of the spillway could be enlarged to pass the probable maximum flood.

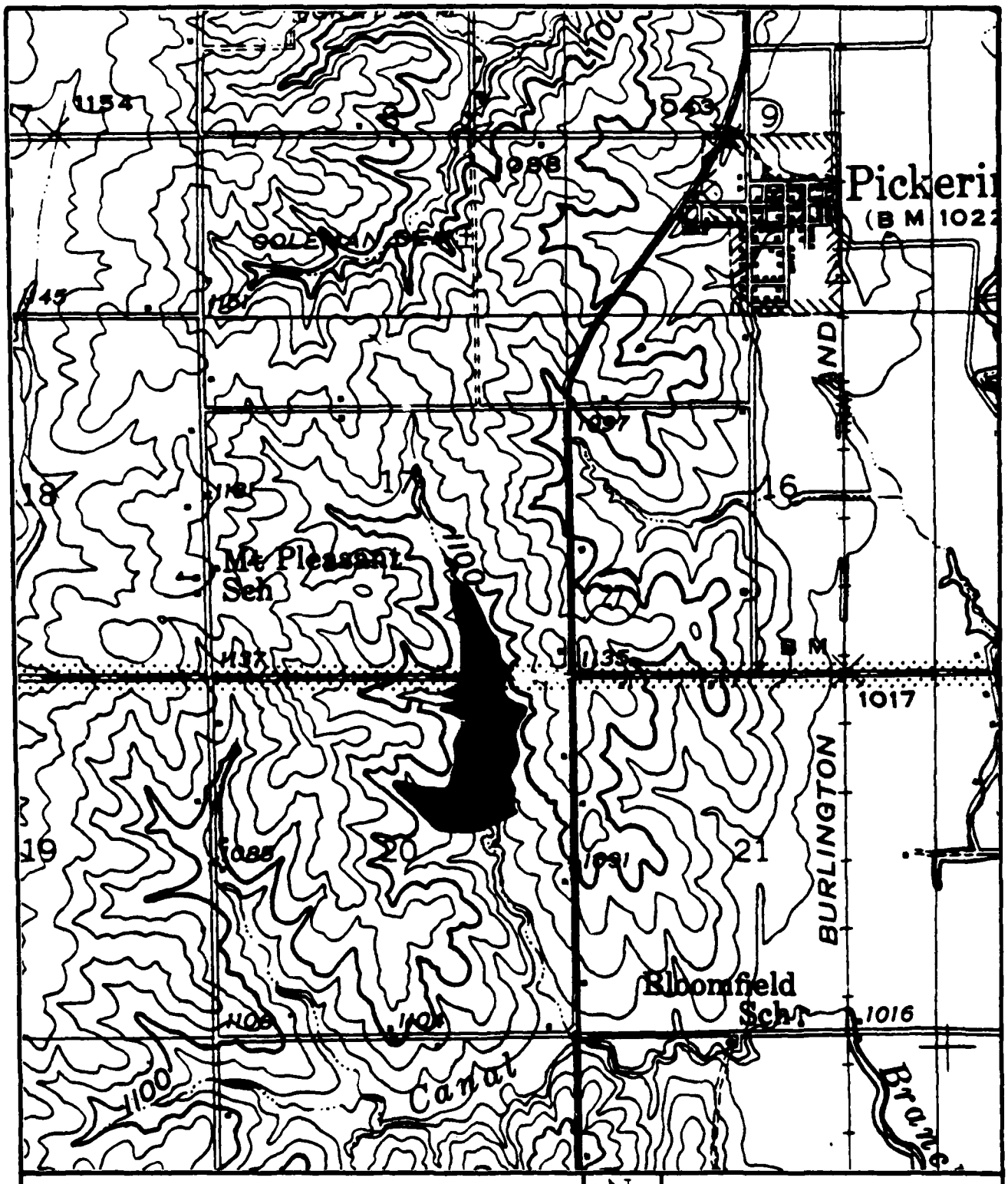
b. O&M Maintenance and Procedures.

(1) The trees should be removed from the upstream face of the dam and measures initiated to prevent recurrence.

(2) Additional riprap should be installed in those areas of the upstream face where wave erosion is evident.

(3) The affects of the tree clogged channel downstream from the principal spillway upon tailwater elevations in the plunge pool are not known. The downstream channel should be cleared of trees and brush and measures initiated to prevent recurrence of growth.

APPENDIX A
MAPS



SCALE IN FEET

2000 1000 0 2000 4000

1000 500 0 1000

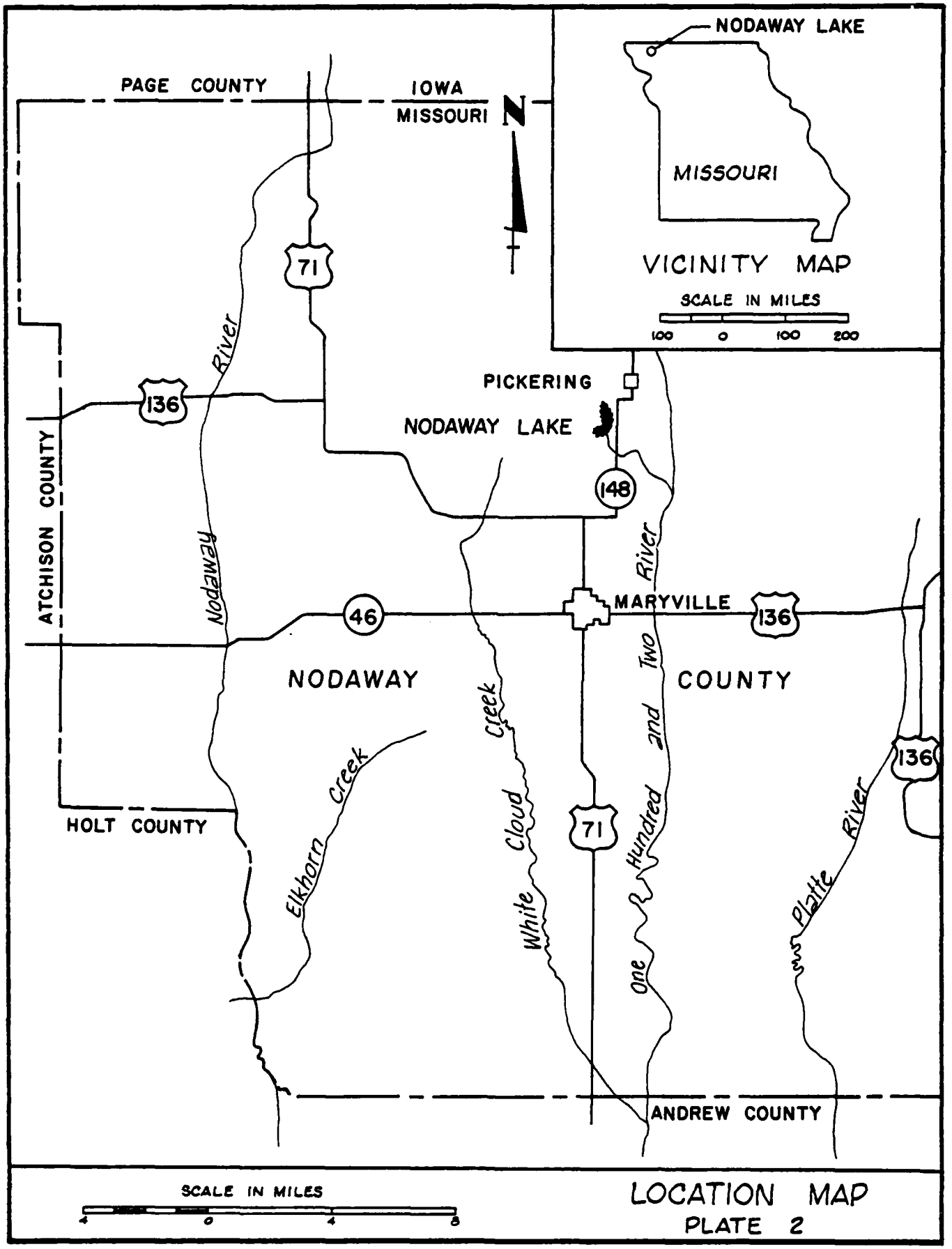
SCALE IN METERS

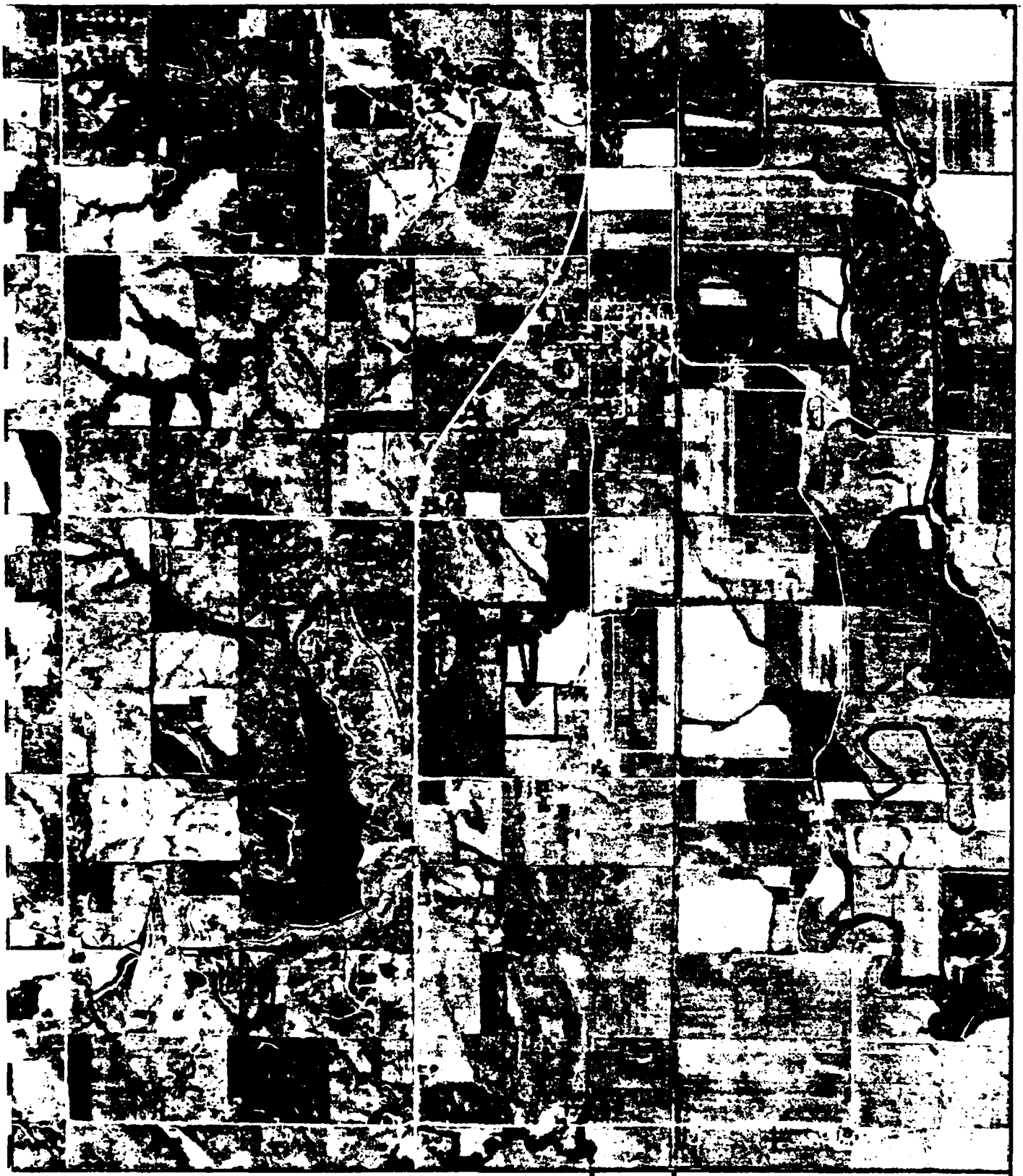
N

NODAWAY LAKE

VICINITY TOPOGRAPHY

PLATE 1


NODAWAY LAKE
PAGE COUNTY
IOWA
MISSOURI
N
MISSOURI
VICINITY MAP
SCALE IN MILES
100 0 100 200
71
River
136
PICKERING
NODAWAY LAKE
148
ATCHISON COUNTY
Nodaway
River
MARYVILLE
46
136
NODAWAY
COUNTY
Two
Creek
and
HOLT COUNTY
Elkhorn
Creek
White Cloud
71
One Hundred
136
Platte River
ANDREW COUNTY
SCALE IN MILES
4 0 4 8
LOCATION MAP
PLATE 2



SCALE IN FEET

2000 1000 0 2000 4000

1000 500 0 1000

SCALE IN METERS

N

NODAWAY LAKE

ORTHOPHOTOGRAPH

PLATE 3

APPENDIX B
PHOTOGRAPHS

PHOTO NO. 2
LOOKING UPSTREAM
IN EMERGENCY
SPILLWAY

PHOTO NO. 3
LOOKING INTO
FOREBAY OF
EMERGENCY
SPILLWAY

PHOTO NO. 4
LOOKING WEST
ACROSS LAKE
AND UPSTREAM
FACE OF DAM

PHOTO NO. 5
UPSTREAM SLOPE
FROM ABOUT
STA. 4+00 TO EAST

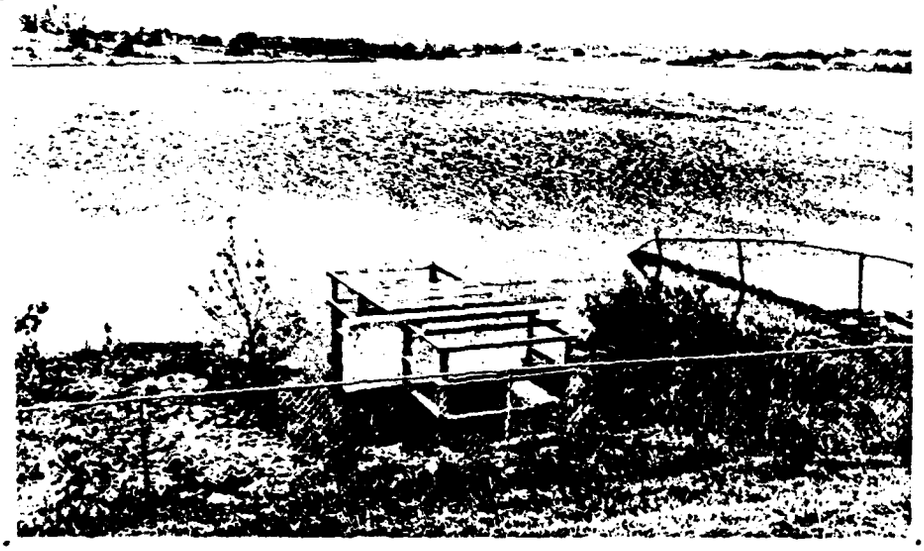


PHOTO NO. 6
PRINCIPAL SPILLWAY
FROM ABOUT
STA. 7+60

PHOTO NO. 7
LOOKING EAST
FROM WEST END
OF DAM

PHOTO NO. 8
LOOKING NORTH
ACROSS RESERVOIR
FROM WEST END
OF DAM

PHOTO NO. 9
LOOKING AT
DOWNSTREAM CHANNEL
FROM TOP OF DAM

PHOTO NO. 10
DOWNSTREAM SLOPE
FROM STA. 3+00
TO EAST

PHOTO NO. 11
LOOKING UPSTREAM
INTO STILLING
BASIN

PHOTO NO. 12
SEEP AREA ON
LEFT SIDE OF
STILLING BASIN

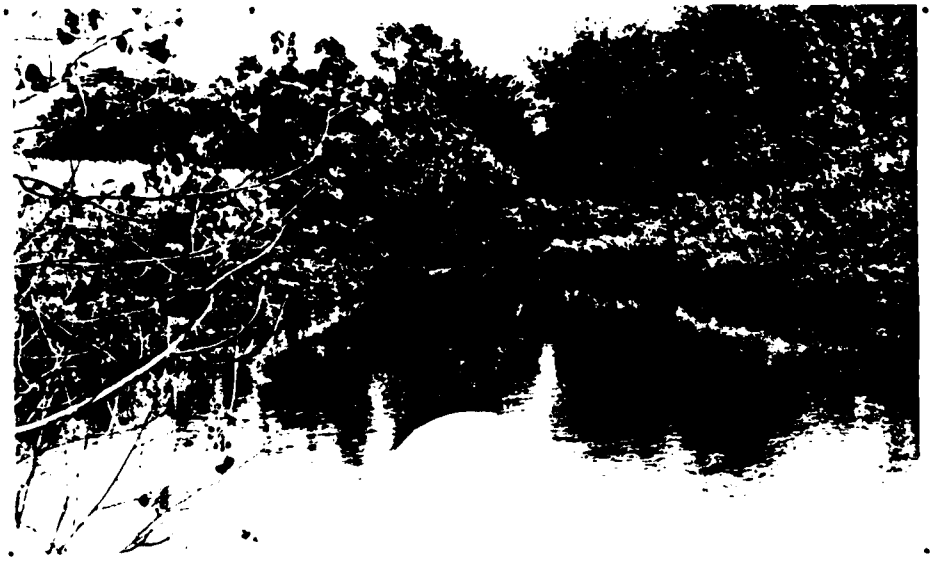
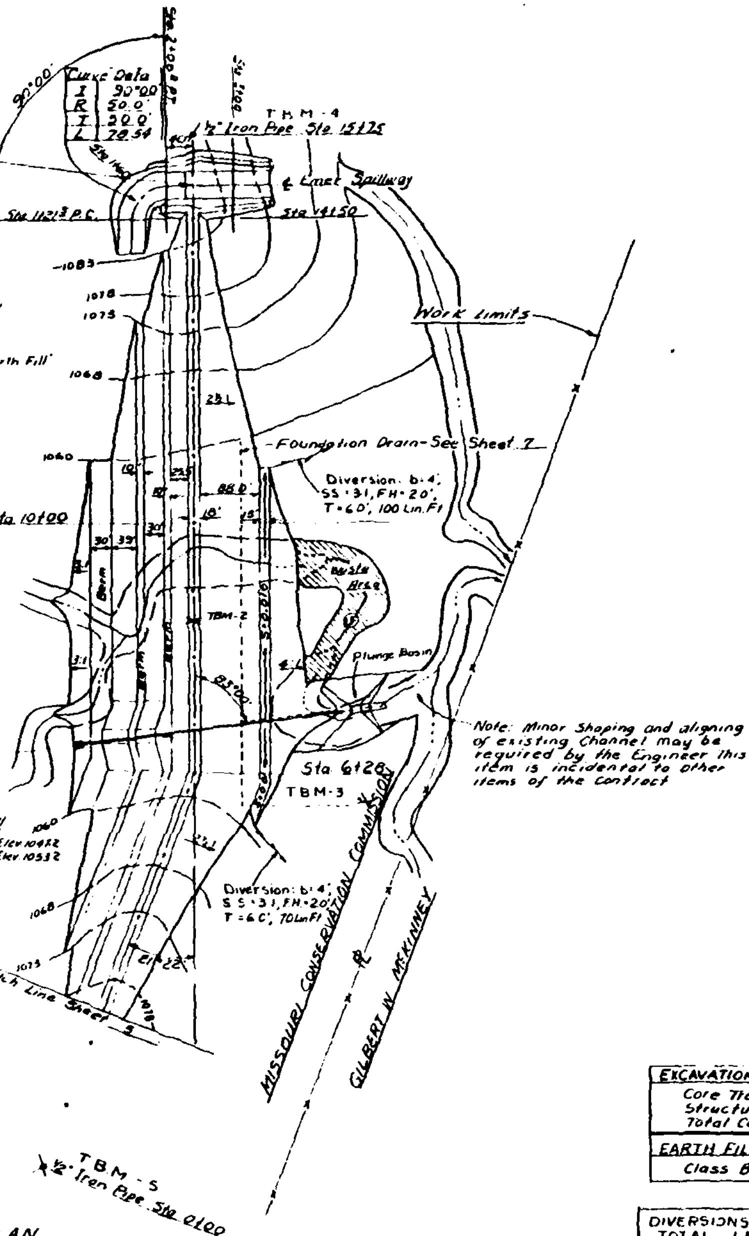


PHOTO NO. 13
LOOKING DOWN
CHANNEL FROM
STILLING BASIN

APPENDIX C
PLANS AND REPORTS



NOTES

Top Soil: The Top Soil Removed From The Foundation And Excavation Areas Shall Be Conserved It Shall Be Spread Within The Neat Lines And Below The Final Grades Of The Earth Fill And Emergency Spillway To A Depth Of Six (6) Inches. To be paid for as "Earth Fill"

Borrow: Borrow Shall Not Be Taken Within 30 Feet Of The Toe Of Fill Slopes. All Borrow Slopes Shall Be 3:1 Unless Otherwise Specified

RIPRAP & FILTER BED to cover the entire upstream slopes and berm between Elevations 1073.0 to 1086.0.

TBM-2 Nail 18" above Ground on NE Side of N Fork of Maple Tree at Sta 8+54 ℄ Fill Elev 1050.22

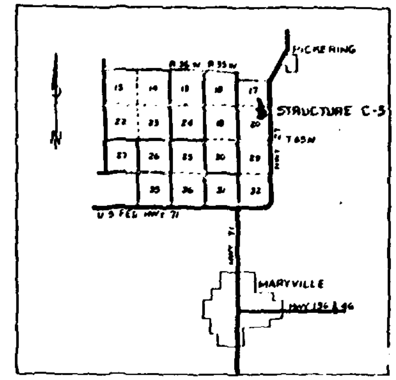
TBM-3 Bent over 16d nail in West root of 12" dia. elder tree, N. bank of gully approx 260' downstream from ℄ Fill vicinity of Sta 6+28, Elev 1051.57

TBM-4 Top ½" Iron Pipe Sta 15+75 ℄ Fill, Elev 1084.84

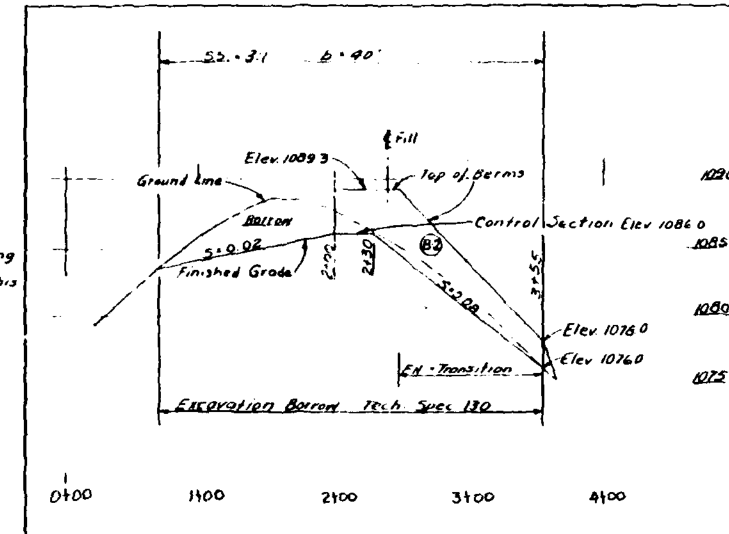
TBM-5 Top of Iron Pipe Sta 0+00 ℄ Fill, Elev 1093.63

PLAN

Scale in Feet



VICINITY MAP



PROFILE ℄ EMERGENCY SPILLWAY

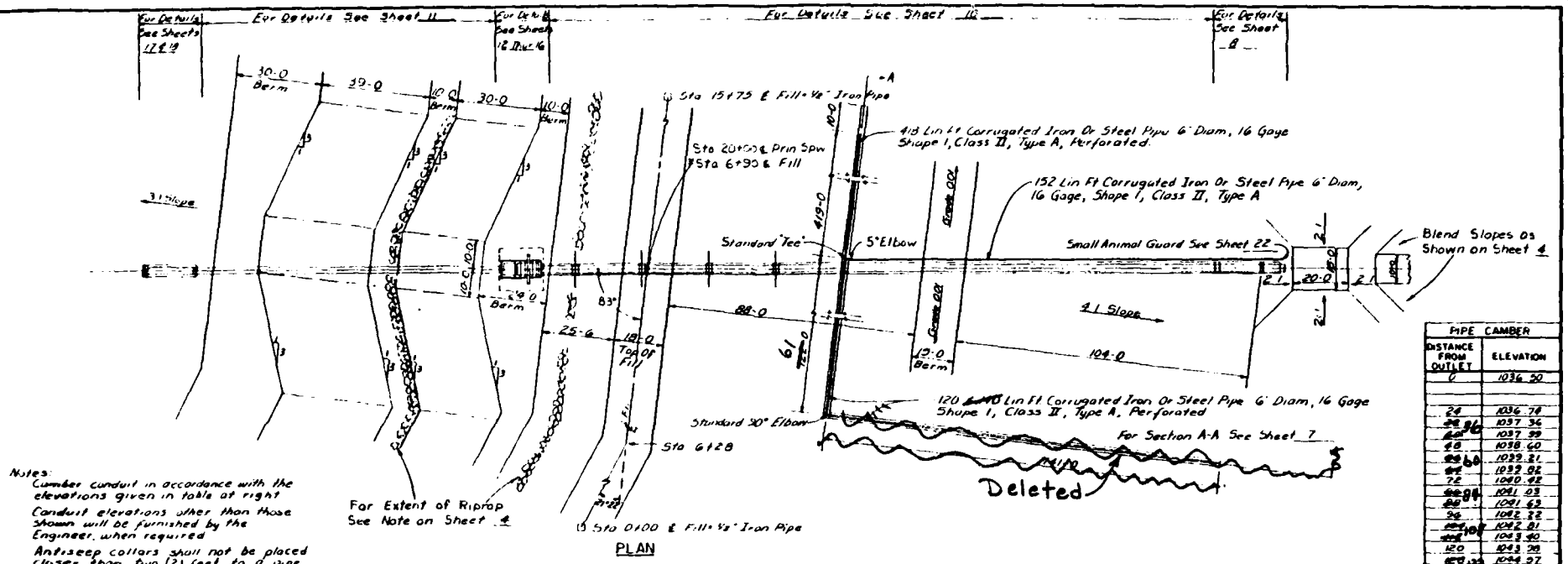
EXCAVATION - COMMON	TECH SPEC 130	
Core Trench	5137 ~~6000~~	Cu Yds
Structure	2792 ~~3,550~~	Cu Yds
Total Common	7929 ~~9,550~~	Cu Yds
EARTH FILL	TECH SPEC 140	
Class B-2	182,709 ~~184,400~~	Cu Yds

DIVERSIONS	TECH SPEC 160	
TOTAL LENGTH	1479 ~~1070~~	Lin Ft

PLAN
STRUCTURE C-3
102 RIVER TRIB WATERSHED PL 566
NODAWAY COUNTY, MISSOURI

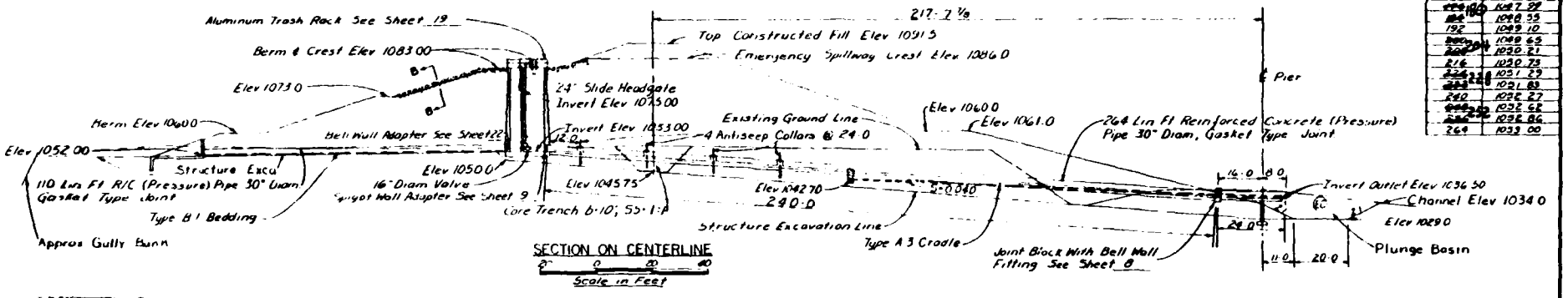
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed	N H Randall	9-63	Approved by
Drawn	B E Smith	9-63	
Traced			
Checked	D D Hale	4-64	Sheet 4 of 21 — Drawing No. 5.E-20,552-P

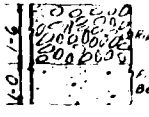


Notes:
Camber conduit in accordance with the elevations given in table at right
Conduit elevations other than those shown will be furnished by the Engineer, when required
Antiseep collars shall not be placed closer than two (2) feet to a pipe joint

PIPE CAMBER	
DISTANCE FROM OUTLET	ELEVATION
0	1036.50
24	1036.78
~~36~~ 36	1037.34
~~60~~ 60	1037.99
48	1038.60
~~84~~ 84	1039.21
~~84~~ 84	1039.82
72	1040.42
~~96~~ 96	1041.03
~~96~~ 96	1041.63
96	1042.22
~~108~~ 108	1042.81
~~108~~ 108	1043.40
120	1043.98
~~132~~ 132	1044.27
~~144~~ 144	1045.15
144	1045.72
~~156~~ 156	1046.29
~~156~~ 156	1046.86
168	1047.43
~~180~~ 180	1047.99
~~180~~ 180	1048.55
192	1049.10
~~204~~ 204	1049.65
~~204~~ 204	1050.21
216	1050.73
~~228~~ 228	1051.29
~~228~~ 228	1051.83
240	1052.27
~~252~~ 252	1052.68
~~252~~ 252	1052.86
264	1053.00



SECTION ON CENTERLINE
Scale in Feet



SECTION B-B

QUANTITIES

Concrete - Class B, Air Entrained	129	Cu Yds
Concrete - Class E (Minimum Mix 4 Sacks Cement Per Cu. Yd.)	5.7	Cu Yds
Steel Bar Reinforcement	13,758	Pounds
Pipe Conduit - Reinforced Concrete (Piessure) 30" Diam. Gasket Type Joint, Payment Method 1	374	Lin Ft
Structure Drainage - Corrugated Iron or Steel Pipe 6' Diam, 16 Gage, Shape I, Class II, Type A, Perforated	~~480~~ 538	Lin Ft
Structure Drainage - Corrugated Iron or Steel Pipe 6' Diam, 16 Gage, Shape I, Class II, Type A	155	Lin Ft
Structure Drainage - Filter Material	279 ~~391~~	Cu Yds
Riprap - Dumped	3,486 ~~3,999~~	Cu Yds
Riprap - Filter Bed	2,224 ~~2,288~~	Cu Yds
Slide Headgate - 24" Diam	1	Each
Valve - Drawdown, 16" Diam, ASA Class 125	1	Each
Manhole - Frame & Cover, 30"x48"	1	Each
Aluminum Trash Rack & Guard Rail	Lump Sum	

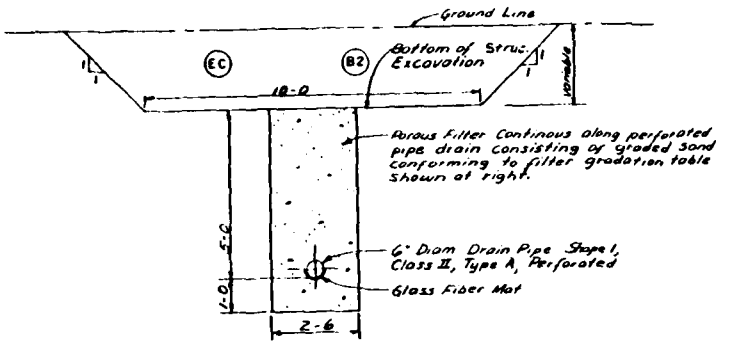
STRUCTURE C-3

R/C DROP INLET FOR 30" DIAM PIPE
GENERAL LAYOUT
102 RIVER TRIB. WATERSHED P.L. 566
NODAWAY COUNTY, MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

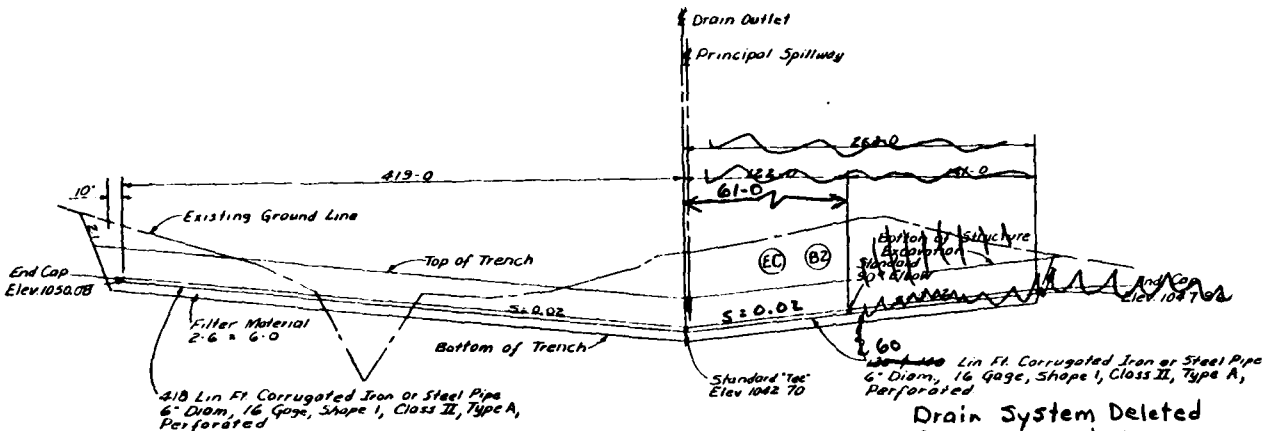
Designed	N. H. Randall	9/63	Approved by
Drawn	B. E. Smith	4/64	Title
Traced	J. D. Naimark	3/64	Date
Checked	D. D. Hale	4/64	Drawing No. 5-E-80,552-P

FILTER GRADATION	
SEIVE SIZE	PERCENT PASSING
¾ IN.	100
NO. 4	95-100
NO. 8	80-100
NO. 16	50-85
NO. 30	25-60
NO. 50	5-30
NO. 100	0-10
NO. 200	Less Than 3



CROSS SECTION OF POROUS FILTER FOR 6" DIAM. PERFORATED HELICAL CM PIPE

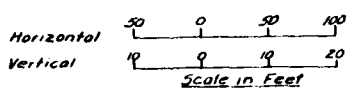
NOTE The glass fiber mat shall be placed to cover the perforations in the Helical CM Pipe. The mat shall be similar in type and equal in quality to "Tile Guard" Type 3-10 as distributed by the Johns-Manville Corporation. Payment for the mat and installation will be considered as incidental to the furnishing and placement of the perforated pipe



Drain System Deleted Beyond 61' Right

SECTION A-A

FOUNDATION TRENCH DRAIN SYSTEM

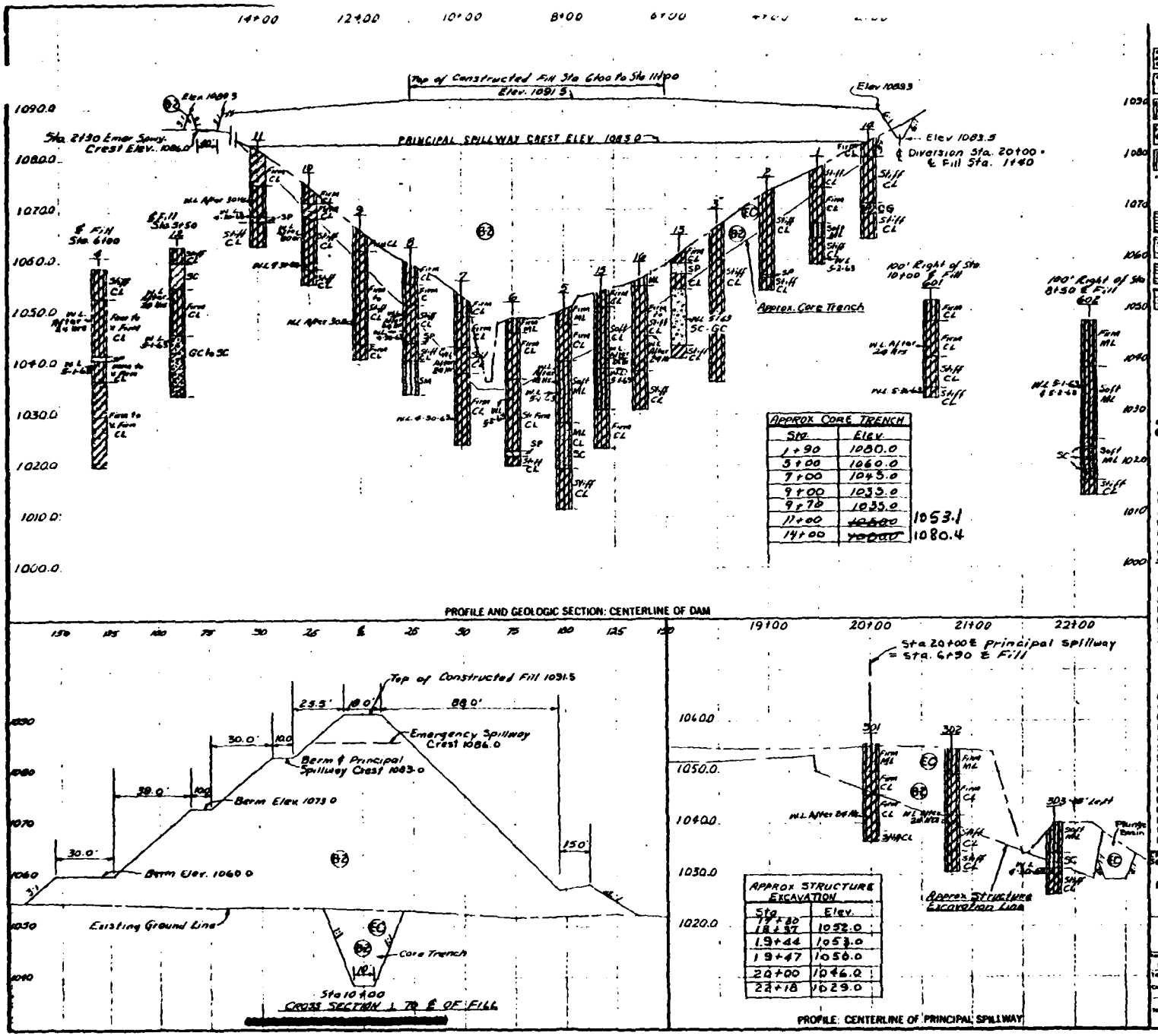


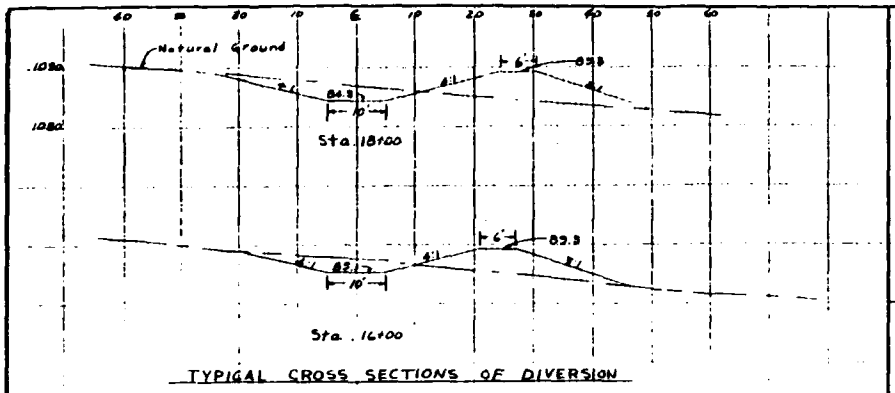
STRUCTURE C-3
FOUNDATION TRENCH DRAIN SYSTEM
102 RIVER TRIB. WATERSHED P.L 566
NODAWAY COUNTY, MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

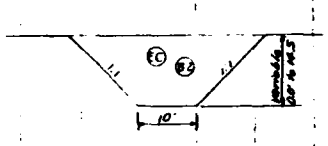
Designed	N. H. Randall	9/63
Drawn	B. E. Smith	4/64
Traced	J. D. Neimark	3/64
Checked	D. D. Hale	4/64

Sheet No. 7 of 23 Sheets
Drawing No. 5-C-20,552-P

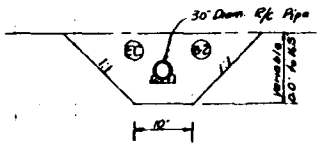

PROFILE AND GEOLOGIC SECTION: CENTERLINE OF DAM
Top of Constructed Fill Sta 6+00 To Sta 11+90
Elev. 1091.5
PRINCIPAL SPILLWAY CREST ELEV. 1083.0
Sta. 21+90 Emer. Spwy. Crest Elev. 1086.0
Elev 1089.3
Elev 1083.5
℄ Diversion Sta. 20+00 • ℄ Fill Sta. 11+60
℄ Fill Sta. 6+00
℄ Fill Sta. 3+50
100' Right of Sta 10+00 ℄ Fill
100' Right of Sta 8+50 ℄ Fill
Approx. Core Trench
Approx Core Trench
Sta | Elev
1+90 | 1080.0
5+00 | 1060.0
7+00 | 1045.0
9+00 | 1035.0
9+78 | 1035.0
11+00 | ~~1050~~ 1053.1
14+00 | ~~1090~~ 1080.4
Top of Constructed Fill 1091.5
Emergency Spillway Crest 1086.0
Berm & Principal Spillway Crest 1083.0
Berm Elev. 1073.0
Berm Elev. 1060.0
Existing Ground Line
Core Trench
Sta 10+00
CROSS SECTION 1 TO ℄ OF FILL
Sta 20+00 ℄ Principal Spillway = Sta. 6+90 ℄ Fill
Approx Structure Excavation Line
Approx Structure Excavation
Sta | Elev.
17+80 | 1052.0
18+97 | 1053.0
19+44 | 1056.0
19+47 | 1056.0
20+00 | 1046.0
22+18 | 1029.0
PROFILE: CENTERLINE OF PRINCIPAL SPILLWAY
UNCONSOLIDATED MATERIAL
CONSOLIDATED MATERIAL
ABBREVIATIONS
TEST HOLE NUMBERING SYSTEM
UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS
CROSS SECTIONS PLAN AND PROFILES FOR GEOLOGIC INVESTIGATIONS
STRUCTURE C-9
102 RIVER TRIBUTARIES WATERSHED P.L.566
NODAWAY COUNTY MISSOURI
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
N. F. EDMONDS 5/63
GEOLOGIST
R. H. RANDALL 5/63
DESIGN ENGINEER
S-E-20558-C



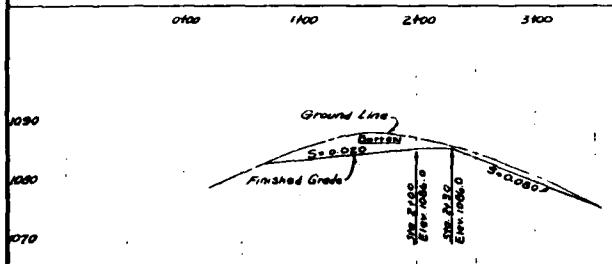
TYPICAL CROSS SECTIONS OF DIVERSION



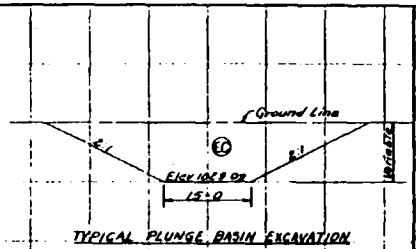
TYPICAL CORE TRENCH EXCAVATION



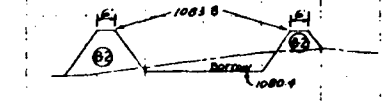
TYPICAL STRUCTURE EXCAVATION
Under Type A-3 Cradle



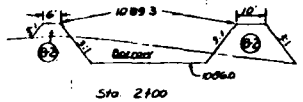
PROFILE: CENTERLINE OF EMERGENCY SPILLWAY



TYPICAL PLUNGE BASIN EXCAVATION



Sta 3+00



Sta 2+00

Sta 1+60

GEOLOGIC CROSS SECTIONS OF EMERGENCY SPILLWAY

LEGEND

SYMBOLS

UNCONSOLIDATED MATERIAL

CONSOLIDATED MATERIAL

ABBREVIATIONS

TEST HOLE NUMBERING SYSTEM

UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS

CROSS SECTIONS PLAN AND PROFILES FOR GEOLOGIC INVESTIGATIONS

STRUCTURE C-3

102 RIVER TRIBUTARIES WATERSHED PL 566

NODAWAY COUNTY, MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed by H. E. EDMONDS	Date 5/63	Approved by	Date
Title GEOLOGIST		Title	
Checked by M. N. RANDALL	Date 5/63		
Title DESIGN ENGINEER		Scale	Drawing No. 5-C-20,552-C

W. S. Culpepper

OFFICE MEMORANDUM -- UNITED STATES GOVERNMENT

TO : W. S. Culpepper, State Conservation Engineer, SCS, Columbia, Missouri

DATE: June 24, 1963

FROM : Roy S. Decker, Head, Soil Mechanics Laboratory, SCS, Lincoln, Nebraska

SUBJECT: Missouri WP-[illegible] Tributaries, Site No. [illegible]

RE : Preliminary Laboratory Report on Consolidation Along the Conduit dated May 18, 1963

ATTACHMENTS

1. Form SCS 354, Soil Mechanics Laboratory Data, 4 sheets.
2. Form SCS 355, Triaxial Shear Test Data, 5 sheets.
3. Form SCS 352, Compaction and Penetration Resistance Report, 7 sheets.
4. Form SCS 357, Summary - Slope Stability Analysis, 3 sheets.

DISCUSSION

FOUNDATION MATERIALS:

A. Classification: This site is located in a glacial till area. The till occurs at the surface on the upper portion of the abutments. Alluvial material mantles the till from about ℄ Station 12+50 on the left abutment to about ℄ Station 6+50 on the right abutment. The glacial till at this site is logged as firm to stiff and is primarily a CL. Localized lenses or strata of sandy material occur in the till throughout the investigational depth. The till in the area between ℄ Station 5+50 and 6+50 appears to have the highest concentration of sandy material. In test hole 13 at ℄ Station 5+75 sandy zones were encountered at the 2 to 4-foot depth and the 7 to 18-foot depth. The zone from 2 to 4 feet is logged as SP and the zone from 7 to 18 feet is logged as SC and GC. Material in the 7 to 18-foot zone appears to be quite variable however. Jar samples from this zone representing the material from 8 to 10 feet and from 12 to 14 feet classed as SM or SC-SM and SM-SP, respectively.

The alluvial material ranges from a few feet thick on the lower portion of the left abutment to a maximum thickness of about 30 feet at ℄ Station 8+00. The alluvium can be separated into four general classes as follows. The surface 3 or 4 feet in the floodplain is logged as firm ML. On the right side of the channel a zone of high plasticity CL or CH underlies the ML. This zone of alluvium is represented by Samples 63W3597 and 63W3825 (core) from test hole 6, and by Samples 63W3824 (core) and 63W3808 from test holes 5 and 15, respectively. A zone of soft alluvium underlies the firm CL and CH zone from about the 10 to 22-foot depth in test hole 5. This soft zone appears to be continuous from about ℄ Station 7+25 to about ℄ Station 10+00. The thickness of this zone ranges from about 5 feet to a

maximum of 12 feet. Core Sample 63W3594 represents this zone. The soft CL zone directly overlies the till, except for the area at ℄ Station 8+00 where a 9-foot zone of stratified silts, clays, and fine sands were encountered on top of the till. A sample from this zone (63W3596) classifies as an SM-SW.

B. Blow Count and Density: Blow count in the zone of firm alluvial CL and CH was in the range of 7 to 8 blows per foot. These tests, although above water table, appear to represent saturated material. Undisturbed samples from 2 to 3 feet above the zone of blow count had a moisture content in the range of 24% which is at 87% or more of theoretical saturation. The density of the material in this zone as represented by Samples 63W3824 and 63W3825 is about 96.0 p.c.f. The natural density of this material appears to be within 5 p.c.f. of maximum Standard density based on a comparison of samples with similar gradation and plasticity from the borrow area.

The zone of soft CL has a blow count of 4 or less blows per foot. Only one blow per foot was recorded in this zone in test hole 5. Core Sample 63W3594 from the soft alluvial zone had a density of about 94.0 p.c.f. to 97 p.c.f. This is a sandy CL and the natural density appears to be in the range of about 85% of Standard Proctor.

The stratified sandy zone underlying the soft CL zone in test hole 5 has blow count of from 6 to 11 and the blow count within the till is generally in the range of 8 to 18 blows per foot.

A core sample from the 19 to 21-foot depth in test hole 6 was from a zone of CL logged as slightly firm. A blow count test from this zone showed 5 blows per foot. The core had a density of from 87.5 p.c.f. to 91 p.c.f. The material is a high plasticity CL. The unconfined compressive strength, the preconsolidation pressure indicated by the consolidation test and the general appearance of the material suggest that the zone represented by this core may actually be till rather than alluvium.

C. Shear Strength: The shear strength of the various foundation materials as indicated by triaxial tests on undisturbed samples are as follows.

(1) $\phi = 21°$, c = 600 p.s.f. for the high plasticity, firm alluvium.

(2) $\phi = 16.5°$, c = 175 p.c.f. for the zone logged as soft alluvium.

(3) $\phi = 16°$, c = 800 p.s.f. is considered to represent the minimum strength of the firm, glacial till.

Based on blow count tests, the stratified alluvial zone, as shown in test hole 5, is expected to have shear strength equivalent to that obtained on Sample 63W3598 (till).

D. Consolidation: Consolidation tests were made on core Samples 63W3594 and 63W3598. The consolidation estimate at the conduit location (℄ 6+90) was reported May 18, 1963.

Total consolidation for the floodplain section is estimated as follows:

(1) The thin zone of surface ML will be largely removed or disturbed and compacted during site preparation; therefore, the consolidation potential within this zone should be negligible.

(2) The firm CL or CH alluvial zone has a relatively high density. The consolidation potential of this material should not exceed that of borrow Sample 63W3615. The test density of 63W3615 was 95.5 p.c.f., which is about equivalent to the natural density of the material in this zone. Borrow Sample 63W3615 is a high plasticity CL that is comparable to the material in this zone. The consolidation potential within the firm CL or CH alluvial zone under the proposed loading is estimated to be 2% or about 0.2 foot.

(3) Sample 63W3594 is considered representative of the soft CL alluvial zone. Consolidation potential within this zone under the proposed loading is estimated to be about 8 percent or 0.9 foot.

(4) The preconsolidation pressure of the till as shown by Sample 63W3598 is in excess of the proposed load; therefore, the till is considered as incompressible.

(5) The blow count in the stratified silt, clay and fine sand layer in test hole 5 is quite high and this zone is also considered as incompressible.

The total consolidation within the floodplain section is estimated to be 1.1 feet.

E. Permeability: The permeability of all materials, except the relatively clean sands (SM-SW and SM-SP), is expected to be very low. Based on the D_{10} size, the sands represented by Samples 63W3596 and 63W3607 are expected to have permeability rates in the range of 2 feet per day. This estimate is based on Hazens equation for permeability and effective size and includes a correction for the D_{60} size.

EMBANKMENT MATERIALS:

A. Classification: The borrow samples submitted are classed as CL. The liquid limits of these materials range from 39 to 47 and PI values range from 15 to 27.

B. Compacted Density: Standard Proctor compaction tests were made on all of the borrow samples submitted. The compacted densities obtained ranged from 98 p.c.f. to 109 p.c.f.

-- W. S. Culpepper -- 6/24/63
Roy S. Decker
Subj: Missouri WP-08, 102 River Tributaries, Site No. C-3

C. Shear Strength: Triaxial shear tests were made on borrow Sample 63W3594. The test was made at 95% of Standard Proctor density at saturation and is considered to represent the glacial till samples submitted. The till samples represent the largest volume of borrow material.

Shear values obtained were $\phi = 8.5°$ and $c = 650$ p.s.f.

SLOPE STABILITY:

The stability of the proposed embankment was checked with a modified Swedish circle method of analysis. The analysis was made for the floodplain section (℄ Station 8+50), the maximum embankment section and a section at the principal spillway location. A phreatic line from emergency spillway elevation was assumed. The following shear strength values were used for the different materials along the assumed failure arcs.

(1) Embankment - $\phi = 8.5°$, $c = 650$ p.s.f.

(2) Firm surface alluvium - $\phi = 21°$, $c = 600$ p.s.f. This zone was considered as 9 feet thick in the floodplain and also at the principal spillway location.

(3) Soft alluvial zone - $\phi = 16.7°$, $c = 175$ p.s.f. This zone was considered as 12 feet thick in the floodplain and 9 feet thick at the principal spillway location.

A summary of the stability analyses is attached (Forms SCS 356). The limiting slopes and berms are shown in the following table.

Section	Slope	E	Berms		Drain	Trial	Fs
			Width	Elevation	Location	No.	
Floodplain	Upstream	3:1	10'	1084.7		8	1.35
			10'	1075.0			
			20'	1060.0			
Floodplain	Upstream	3:1	20'	1084.7		7	1.34
			10'	1072.0			
			20'	1060.0			
Floodplain	Downstream	2½:1/3:1	15'	1060.0	c/b = 0.6	11	1.3[illegible]
Floodplain	Downstream	2½:1/3:1	15'	1060.0	c/b = 0.3	10	1.4[illegible]

RECOMMENDATIONS

A. Centerline Cutoff: The following cutoff trench depths are suggested.

℄ Station	Trench Depth, Feet	Bottoms In
2+00	6.0	CL Till
3+00	6.0	CL Till
4+00	6.0	CL Till
5+00	6.0	CL Till
5+50	8.0	CL Till
6+00	6.0	CL Till
8+00	6.0	CH Alluvium
9+00	6.0	CL or CH Alluvium
10+00	6.0	CL Alluvium
11+00	6.0	CL Alluvium
12+00	6.0	CL Till
13+00	7.0	CL Till
14+00	7.0	CL Till

The 6.0-foot minimum depth is suggested to insure that the trench bottoms below the zone affected by drying cracks.

It appears that a deep trench in the range of 15 to 15 feet would be required to cut off the sandy zones at ℄ Station 5+75. As an alternative to a deep cutoff at this location, a shallow cutoff (6.0 feet) with a deep trench drain could be used for this section.

The trench should be backfilled with CL and compacted to a minimum of 95 percent of Standard Proctor density.

B. Principal Spillway: See preliminary report dated May 15, 1963.

C. Drain: A drain is required for embankment stability with the proposed 2 1/2:1 over all downstream slope with a 15-foot berm at elevation 1060. In view of the sandy zones that appear to occur intermittently, a drain is considered desirable for this foundation also.

A foundation trench drain is proposed since it will control the phreatic line within the embankment and also provide protection against piping. The drain location will afford adequate the desired factor of safety of the downstream slope. For a Class A embankment, the drain can be located at c/b = 0.6 (F_s = 1.5). For a Class B or C dam, the drain should be located at about c/b = 0.5 in order to obtain a factor of safety in the range of 1.5. The drain should extend up the abutments to about elevation 1060. The trench should penetrate the foundation about 6 feet, except in the vicinity of ℄ Station 5+75 where a trench cutoff of at least 12 feet is suggested.

A designed filter is not required for the drain. The exception to this may be in the area of ℄ Station 5+75 (vert hole 13) where the drain material will be in contact with the sandy lenses or strata. Any reasonably well-graded, clean sand-gravel mixture may be used for the drain

where the drain will be in contact with CL. For the sandy areas where the drain will be in contact with materials like the SM and SM-SP strata in test hole 13, a designed filter should be used.

D. Embankment Design:

1. Placement of Materials: A homogeneous embankment of CL material is recommended. The embankment material should be placed at a minimum of 95 percent of Standard Proctor density. The placement moisture content should be maintained at optimum or above.

2. Slopes: The following slopes have satisfactory factors of safety and are recommended.

A. Upstream: 3:1 with 10-foot berms at elevation 1084.7 and 1073 and a 30-foot berm at elevation 1060.

Where the 24-foot berm is required around the inlet (Elevation 1084.7), the upstream slope could be modified as follows: 3:1 with a 24-foot berm at elevation 1084.7; a 10-foot berm at elevation 1073; and a 20-foot berm at elevation 1060.

B. Downstream: 2 1/2:1 above with a 15-foot berm at elevation 1060 and a 4:1 slope below the berm.

3. Settlement: An overfill allowance of 1.75 feet is suggested to compensate for residual consolidation within the foundation and the embankment.

Prepared by:

Lorn P. Dunnigan

Reviewed and Approved by:

Roland B. Phillips

Attachments

cc: W. S. Culpepper (2)
H. J. Behrens, Milwaukee, Wisconsin
Harold Townsend, Bethany, Missouri (2)

Form SCS- 394
Rev. 2/59

May 22, 1963

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MISSOURI

LABORATORY SAMPLE NUMBER	FIELD NUMBER	LOCATION AND DESCRIPTION	DEPTH	FIELD CLASSIFICATION	MECHANICAL ANALYSIS — GRAIN SIZE DISTRIBUTION EXPRESSED AS PERCENT FINER BY DRY WEIGHT: FINES 0.002 mm	0.005	0.02	0.05	#200 0.074	SANDS #140 0.105	#60 0.250	#40 0.42	#20 0.84	#10 2.0	#4 4.76	GRAVEL 3/8" 9.525	1/2" 12.7	3/4" 19.05	1" 50.1	1 1/2" 38.4	3" 76.2 mm	ATTERBERG LIMITS LL	PI	UNIFIED CLASSIFICATION	SOLUBLE SALTS %	DISPERSION %	MOISTURE - DENSITY RELATIONSHIPS ☐ STANDARD ☐ MODIFIED CURVE NO.	DRY DENSITY lbs/cu ft	OPTIMUM MOISTURE %	UNDISTURBED SAMPLE DATA DRY UNIT WEIGHT g/cc	MOISTURE %	G_s	
6314		102 River Tributary Site No. C-3																															
3824	5.7	℄ Fill 8+05 Core	5.5-6'		37	43	72	92	95					100								57	34	CH		16						2.66	V
3825	6.5	℄ Fill 8+95 Core	7.5-8'		31	37	62	79	81					100								48	24	CL		22						2.7	

Returned 6/5

Form SCS- 350
Rev. 3/58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

May 7, 1963

LABORATORY SAMPLE NUMBER	FIELD NUMBER	LOCATION AND DESCRIPTION	DEPTH	FIELD CLASSIFICATION	MECHANICAL ANALYSIS — GRAIN SIZE DISTRIBUTION EXPRESSED AS PERCENT FINER BY DRY WEIGHT: FINES					SANDS					GRAVEL						ATTERBERG LIMITS		UNIFIED CLASSIFICATION	SOLUBLE SALTS %	DISPERSION %	MOISTURE - DENSITY RELATIONSHIPS (☒ STANDARD ☐ MODIFIED): CURVE NO	DRY DENSITY lbs/cu ft	OPTIMUM H_2O %	UNDISTURBED SAMPLE DATA: DRY UNIT WEIGHT g/cc	H_2O %	G_s	
					.002 mm	.005	.02	.05	#200 .074	#140 .105	#80 .250	#40 .42	#20 .84	#10 2.0	#4 4.76	3/8" 9.525	1/2" 12.7	3/4" 19.05	1" 38.1	1 1/2" 38.4	3" 76.2 mm	L L	P I									
63W		102 River Tributaries Site No. C-3																													
3615	104-1	Borrow D+30 7+60 L. Bag	1-7'		30	35	60	82	98					100							44	19	CL			(3)	101.0	11[illegible]			[illegible]
3616	105-1	Borrow 0+00 6+00 L. Bag	0-4'		33	39	47	60	66					100							47	26	CL			(4)	[illegible]	[illegible]			[illegible]
		Till																													
3617	105-2	Borrow 0+00 6+00 L. Bag	4-12'		36	41	53	68	72					100							45	27	CL			[illegible]	[illegible]	[illegible]			[illegible]
		Till																													
3618	106-1	Borrow H+00 9+00 L. Bag	0-3'		24	32	53	80	87					100							39	15	CL			(6)	99.0	[illegible]			[illegible]
		Terrace fill material																													
3619	106-2	Borrow H+00 9+00 L. Bag	3-8'		30	39	61	83	98					100							42	22	CL			[illegible]	[illegible]	[illegible]			[illegible]
		Terrace fill material																													

... REPORTED

Form SCS-354
Rev. 5/58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

May 7, 1963

MISSOURI

102 River Tributaries Site No. C-3

Laboratory sample number series: 63W

Mechanical analysis: grain size distribution expressed as percent finer by dry weight

Moisture-density relationships: ☒ Standard ☐ Modified

Laboratory Sample Number	Field Number	Location and Description			Depth	Field Classification	Fines 0.002 mm	Fines 0.005	Fines 0.02	Fines 0.05	Fines #200 0.074	Sands #140 0.105	Sands #60 0.250	Sands #40 0.42	Sands #20 0.84	Sands #10 2.0	Sands #4 4.76	Gravel 3/8" 9.525	Gravel 1/2" 12.7	Gravel 3/4" 19.05	Gravel 1" 25.4	Gravel 1 1/2" 38.1	Gravel 3" 76.2 mm	Atterberg Limits LL	Atterberg Limits PI	Unified Classification	Soluble Salts %	Dispersion %	Moisture-Density Curve No.	Dry Density lbs/cu ft	Optimum H_2O %	Undisturbed Dry Unit Weight g/cc	Undisturbed H_2O %	G_s	
3606	13-1	℄ Fill	5+75	Jar	8-10'		12	14	17	19	24	25	30	34	63	82	95	100															[illegible]		
3607	13-2	"	"	Jar	12-14'		5	8	9	9	11	11	13	15	36	66	90	99	100							SM-[illegible]							15.[illegible]		
3608	15-1	"	7+25	Jar	9.5'-10.5'		29	37	68	93	94					100																	[illegible]		
3609	15-2	"	"	Jar	14.5-15.5'		25	29	51	74	80					100																	30.5		
3610	15-3	"	"	Jar	19.5'-20.5'		22	27	48	81	90					100																	[illegible]		
3611	15-4	"	"	Jar	24.5'-25.5'		29	39	56	66	69					100																	[illegible]		
3612	16-2	"	6+50	Jar	19.5'-20.5'		31	39	54	66	70					100																	20.[illegible]		
3613	101-1	Composite 0+00	12+00	L. Bag Comp.			34	39	53	62	72					100								46	27	CL			(1)	[illegible]	16.[illegible]			[illegible]	✓
	102-1	Borrow 0+00	13+00		1-6'																														
		[illegible]																																	
3614	101-2	Composite C+00	12+00	L. Bag Composite			29	32	41	50	55					100								41	22	L			(2)	[illegible]	[illegible]			2[illegible]	
	102-2	Borrow 0+00	13+00		6-12'																														
		[illegible]																																	

... REPORTED [illegible]

Form SCS- 369
Rev. 3/59
May 7, 1963

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

MISSOURI

102 River Tributaries — Site No. C-3

LABORATORY SAMPLE NUMBER	FIELD NUMBER	LOCATION AND DESCRIPTION			DEPTH	FIELD CLASSIFICATION	MECHANICAL ANALYSIS — GRAIN SIZE DISTRIBUTION EXPRESSED AS PERCENT FINER BY DRY WEIGHT: FINES 0.002 mm	0.005	0.02	0.05	#200 0.074	SANDS #100 0.105	#60 0.250	#40 0.42	#20 0.84	#10 2.0	#4 4.76	GRAVEL 3/8" 9.525	1/2" 12.7	3/4" 19.05	1" 50.1	1 1/2" 38.4	3" 76.2 mm	ATTERBERG LIMITS: L L	P I	UNIFIED CLASSIFICATION	SOLUBLE SALTS %	DISPERSION %	MOISTURE - DENSITY RELATIONSHIPS: ☐ STANDARD ☐ MODIFIED — CURVE NO	DRY DENSITY lbs/ft³	OPTIMUM H_2O %	UNDISTURBED SAMPLE DATA: DRY UNIT WEIGHT g/cc	H_2O %	G_s		
63W		102 River Tributaries		Site No. C-3																																
3594	5-2	€ Fill	8+00	Core	14-16'		18	25	39	60	69					100								31	14	CL		24								
3595	5-3	€ Fill	"	Jar	19.5'-20.5'		16	21	28	47	56					100																				
3596	5-4	€ Fill	"	Jar	24.5-25.5'		2	5	6	7	12	14	23	39	57	65	75	85	90	100															
3597	6-1	"	9+00	Jar	9.5'-10.5'		37	45	73	87	91					100																				
3598	6-3	"	"	Core	19-21'		30	35	62	90	94					100								46	24	CL		31								
3599	6-4	"	"	Jar	24.5'-25.5'		23	27	43	61	73					100																				
3600	7-1	"	10+00	Jar	14.5'-15.5'		23	26	46	63	68					100																				
3601	7-2	"	"	Jar	19.5'-20.5'		27	30	54	67	71					100																				
3602	8-2	"	11+00	Jar	14.5'-15.5'		20	22	28	40	49	52	67	81	96	100																				
3603	8-3	"	"	Jar	19-20'		12	15	24	40	57	66	92	97	99	100																				
3604	8-4	"	"	Jar	24.5-25.5'		4	11	21	55	73					100																				
3605	9-1	"	12+00	Jar	15.5'-16.5'		35	41	59	64	68					100																				

REPORTED

SCS-355 (Rev. 4/59)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY

Sample Number 631/2594

TRIAXIAL SHEAR TEST DATA

Project 10? RIVER TRIBUTARIES Location MISSOURI

Moisture-Density Data

Standard ☐ Max. γ _____ pcf
Modified ☐ Optimum Moisture _____ %
Curve No. ___ of ___

L.L. 31 P.I. 14 Class CL G_s Estim
% Finer Than: 0.002mm 18 0.005mm 25 #200 69
Other Factors Affecting Shear:
% Dispersion 24 % Salt _____
Other: _____

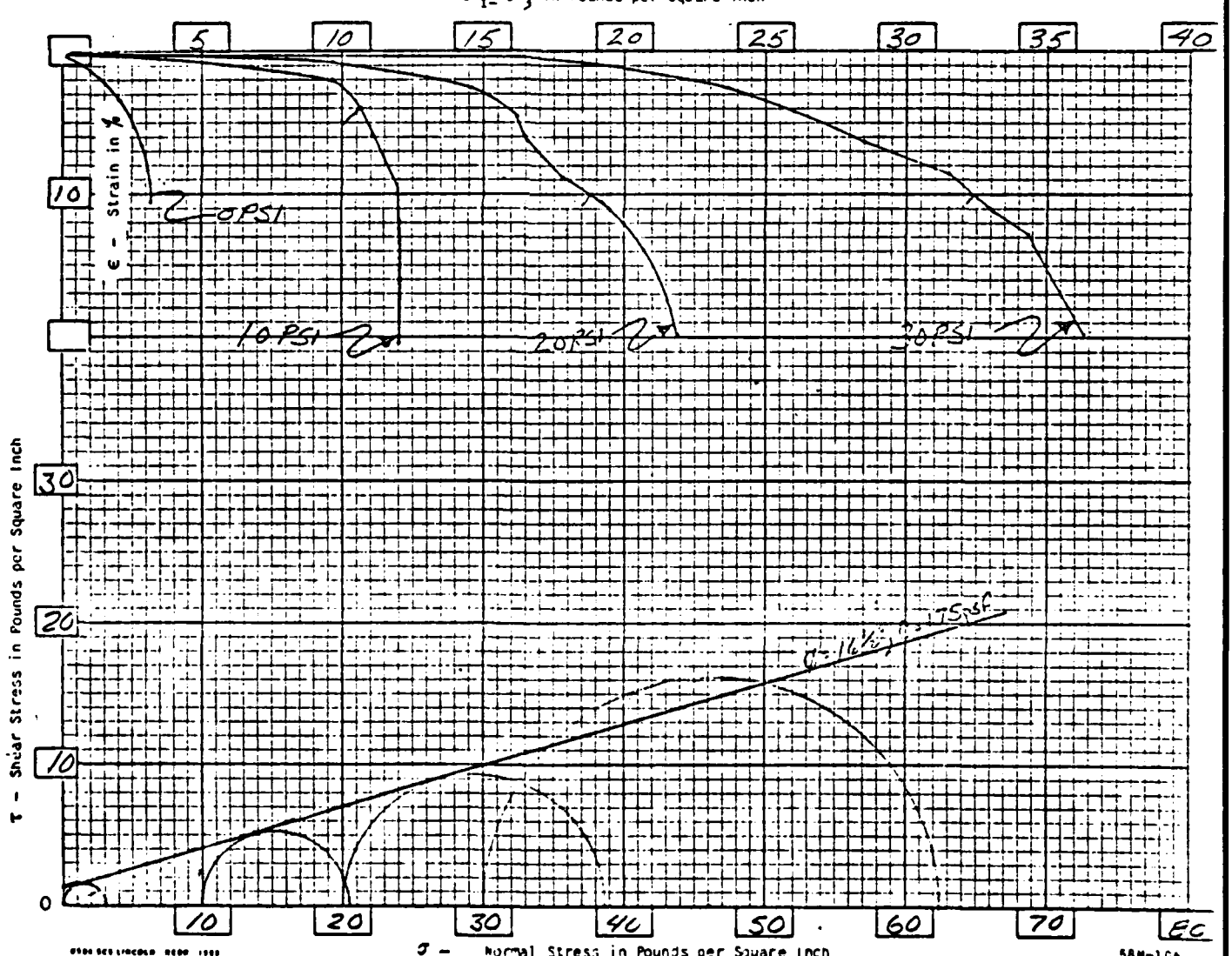
Specifications:

Specimen: Height 3.0" Diameter 1.4" Max. Size <#10 Material
☒ Consolidated ☐ Drained
☐ Unconsolidated ☒ Undrained
☒ Undisturbed and Tested at: ☒ Natural Moisture ☐ Saturation
☐ Remolded and Tested at: ___ % of ☐ Standard ☐ Modified
with w = _____ % which is
☐ Lower than Optimum ☐ Optimum ☐ Higher than Optimum ☐ Saturated

Test Data

BEFORE AFTER

Dry Density γ pcf	% Max. Dry Den.	Moisture Content: Start %	Moisture Content: % Sat. @ Start	Moisture Content: End %	Lateral Pressure σ_3	Consolidation Data: Orig. e_0	Consolidation Data: Final e_f	Stress at Failure $\sigma_1 - \sigma_3$	% Strain at Failure ε	Internal Friction ϕ Tan ϕ	Unit Cohesion
1.52		27.7	92.2	27.4	0	.7501		3.2	9.2	ϕ_0	1.2 psi
1.52	1.56	27.9	98.9	25.6	10	.7501	.7050	10.6	4.0	$16\frac{1}{2}$	175 psf
1.44	1.52	28.9	90.9	24.5	20	.8471	.7501	18.7	10.0		
1.57	1.69	25.9	99.2	21.1	30	.6743	.5741	32.4	10.6	Tan ϕ	



58M-106

SCS-355 (Rev. 4/59)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY
TRIAXIAL SHEAR TEST DATA

Sample Number 63W3598

Project _____ Location _____

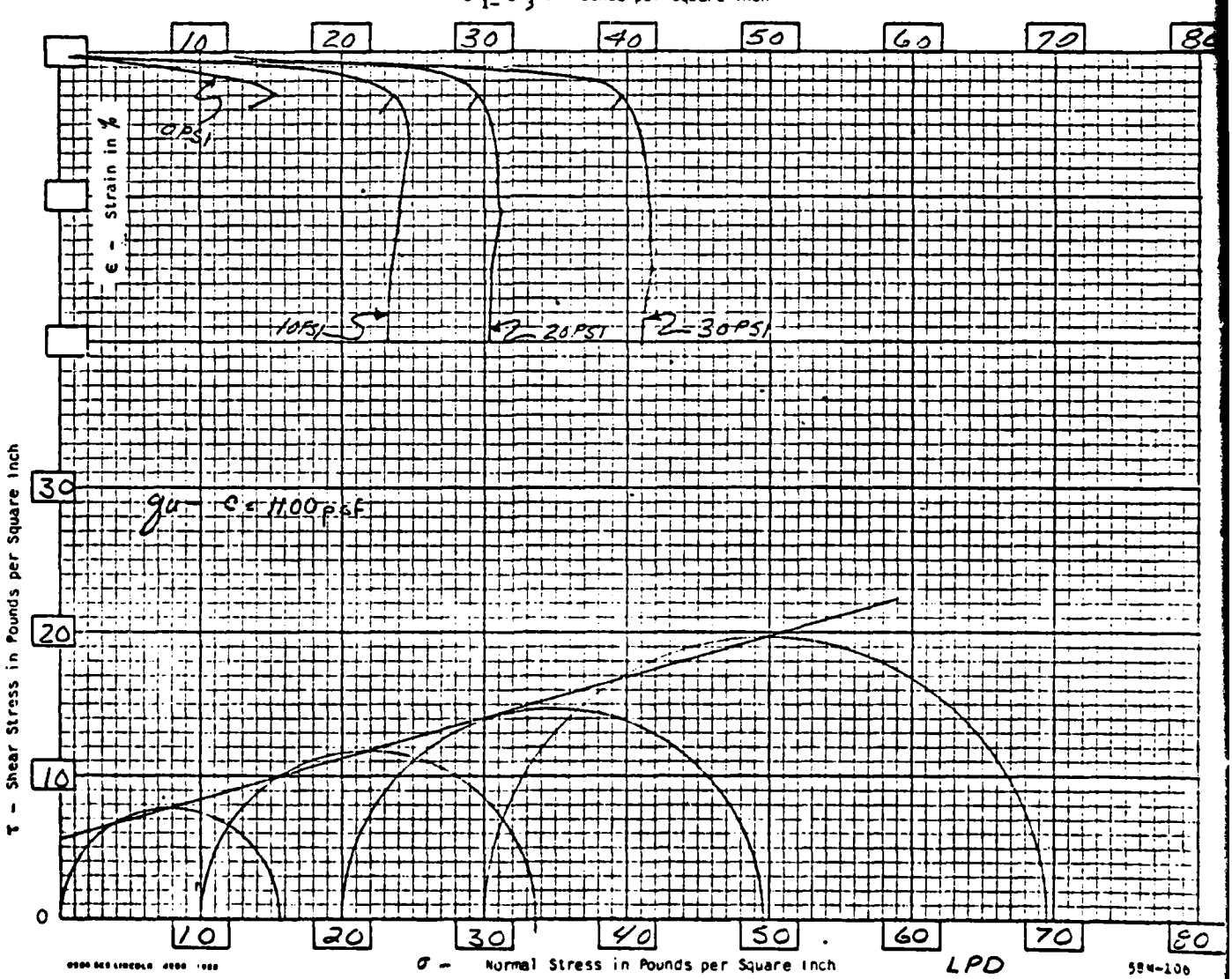
Moisture-Density Data
Standard ☐ Max. γ _____ pcf
Modified ☐ Optimum Moisture _____ %
Curve No. ___ of ___

L.L. 46 P.I. 24 Class CL G_s 2.68
% Finer Than: 0.002mm 32 0.005mm 35 #200 96
Other Factors Affecting Shear:
% Dispersion 31 % Salt _____
Other: _____

Specifications:
Specimen: Height 3.0" Max. Size <#10 Diameter 1.4"
☒ Consolidated ☐ Unconsolidated ☐ Drained ☒ Undrained
Material
☐ Undisturbed and Tested at: ☒ Natural Moisture ☐ Saturation
☐ Remolded and Tested at: ___ % of ☐ Standard ☐ Modified
with w = _____ % which is
☐ Lower than Optimum ☐ Optimum ☐ Higher than Optimum ☐ Saturated

Test Data

Dry Density γ pcf	% Max. Dry Den.	Moisture Content Start %	Moisture Content % Sat. Start	Moisture Content End %	Lateral Pressure σ_3	Consolidation Data Orig. e_0	Consolidation Data Final e_f	Stress at Failure $\sigma_1 - \sigma_3$	% Strain at Failure ε	Internal Friction ϕ Tan ϕ	Unit Cohesion
1.46		30.8	98.7	30.9	0	.8355		15.3	3.0	ϕ 16°	55 psi
1.39	1.41	33.7	97.4	34.2	10	.9279	.9008	23.7	3.0		800 psf
1.38	1.42	34.5	96.0	33.5	20	.9421	.8871	29.5	3.0		
1.45	1.48	30.9	97.5	30.1	30	.8484	.8107	39.6	3.0	Tan ϕ	



SCS-355 (Rev. 4/59)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY
TRIAXIAL SHEAR TEST DATA

Sample Number 63A13613

Project 102 River Trib. Site C-3 Location Missouri

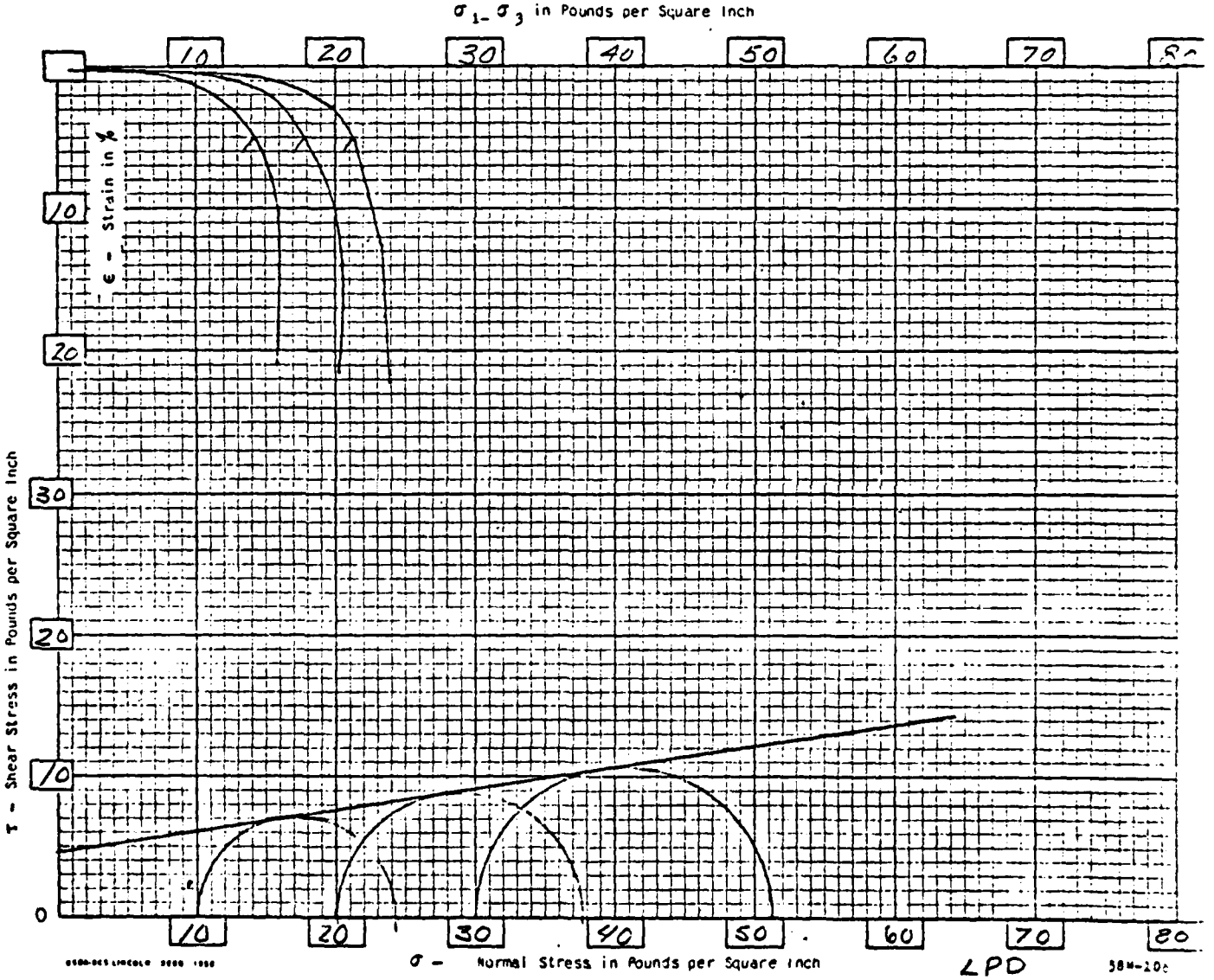
Moisture-Density Data
- Standard ☑ Max. γ 106.0 pcf
- Modified ☐ Optimum Moisture 16.5 %
- Curve No. 1 of ___

L.L. 46 P.I. 27 Class CL G_s 2.66
% Finer Than: 0.002mm 34 0.005mm 39 #200 72
Other Factors Affecting Shear:
% Dispersion _____ % Salt _____
Other: Molded at Saturation

Specifications:
Specimen: Height 3.0" Max. Size < #10 Diameter 1.4"
☑ Consolidated ☐ Unconsolidated ☐ Drained ☑ Undrained
☐ Undisturbed and Tested at: ☐ Natural Moisture ☐ Saturation
☑ Remolded and Tested at: 95 % of ☑ Standard ☐ Modified
with w = _____ % which is
☐ Lower than Optimum ☐ Optimum ☐ Higher than Optimum ☑ Saturated

Test Data

Dry Density γ pcf	% Max. Dry Den.	Moisture Content Start %	Moisture Content % Sat. Start	Moisture Content End %	Lateral Pressure σ_3	Consolidation Data Orig. e_0	Consolidation Data Final e_f	Stress at Failure $\sigma_1 - \sigma_3$	% Strain at Failure ε	Internal Friction ϕ Tan ϕ	Unit Cohesion
99.8	94.2	24.3	97.6	24.0	10	.6625	.6625	14.2	5.0	ϕ 8.5°	4.5 psi
99.8	94.2	24.3	97.6	23.3	20	.6625	.6121	17.8	5.0		650 psf
100.5	94.8	24.2	98.8	22.9	30	.6521	.5647	21.2	5.0	Tan ϕ	



LPD

58M-10

-355 (Rev. 4/59)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY

Sample Number 63W3613

TRIAXIAL SHEAR TEST DATA

Project 102 River Tr. 6 Site C-3 Location Missouri

Moisture-Density Data

Standard ☒ Max. γ 105.0 pcf
Modified ☐ Optimum Moisture 17.0 %
Curve No. ___ of ___

L.L. 46 P.I. 27 Class CL G_s 2.66
% Finer Than: 0.002mm 34 0.005mm 39 #200 72
Other Factors Affecting Shear:
% Dispersion _____ % Salt _____
Other: _____

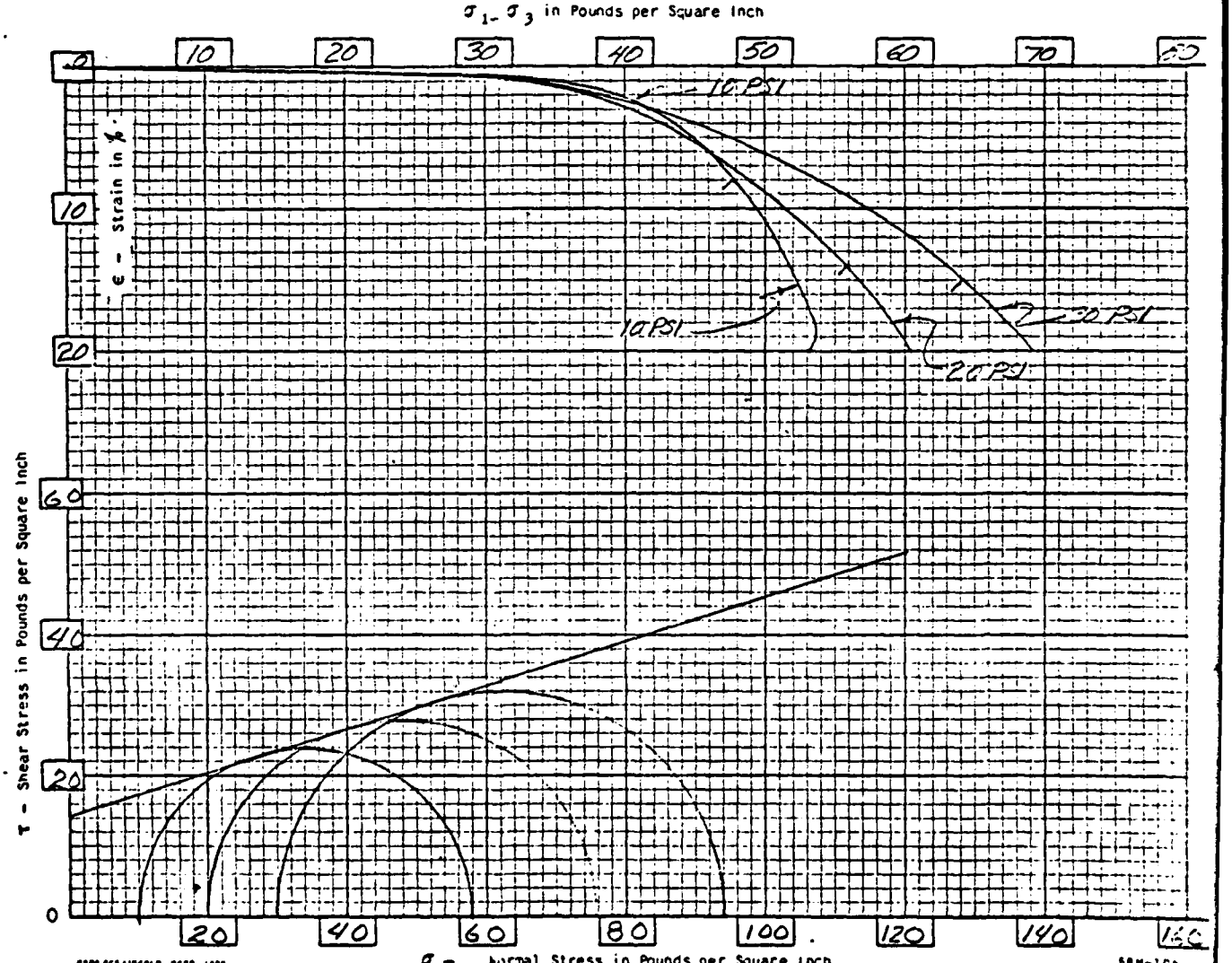
Specifications:

Specimen: Max. Height 3.0" Size <#10 Diameter 1.4" Material
☒ Consolidated ☐ Drained ☐ Unconsolidated ☐ Undrained

☐ Undisturbed and Tested at: ☐ Natural Moisture ☐ Saturation
☒ Remolded and Tested at: 95 % of ☒ Standard ☐ Modified
with w = 17.0 % which is
☐ Lower than Optimum ☒ Optimum ☐ Higher than Optimum ☐ Saturated

Test Data

Dry Density γ pcf	% Max. Dry Den.	Moisture Content Start %	Moisture Content % Sat. @ Start	Moisture Content End %	Lateral Pressure σ_3	Consolidation Data Orig. e_0	Consolidation Data Final e_f	Stress at Failure $\sigma_1 - \sigma_3$	% Strain at Failure F	Internal Friction ϕ Tan ϕ	Unit Cohesion
99.8	95.0	16.3		16.0	10			47.8	8	ϕ 17½°	14 psi
99.2	94.5	16.2		15.9	20			55.8	14		1950 psf
100.5	95.7	16.2		15.9	30			64.0	15	Tan ϕ	



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SCS-355 (Rev. 4/59)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY

Sample Number 63W3829

TRIAXIAL SHEAR TEST DATA

Project 112 River Trib. Site C-3 Location Mo.

Moisture-Density Data
Standard ☐ Max. γ _____ pcf
Modified ☐ Optimum Moisture _____ %
Curve No. ___ of ___

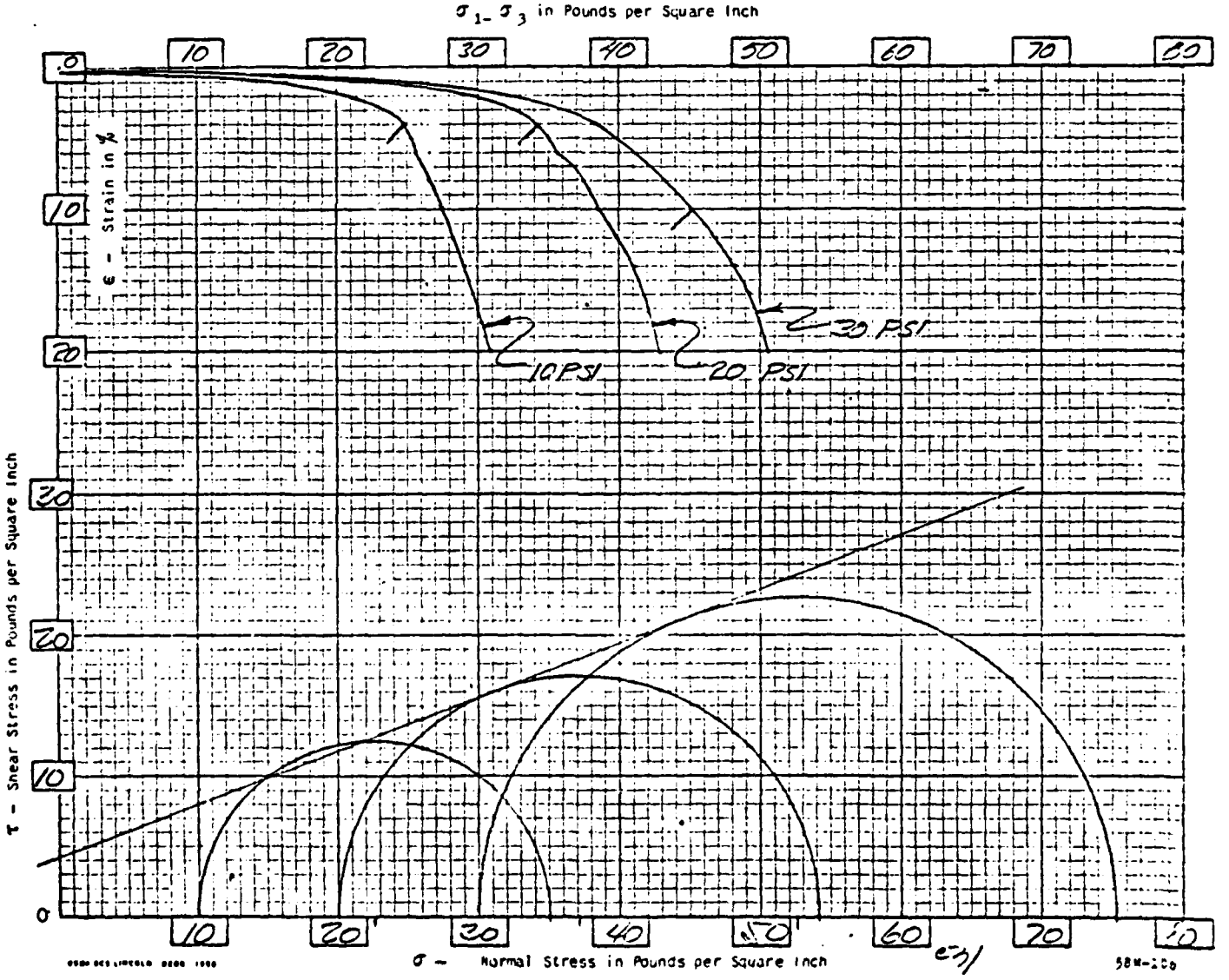
L.L. 57 P.I. 34 Class CH G_s 2.66
% Finer Than: 0.002mm 37 0.005mm 42 #200 95
Other Factors Affecting Shear:
% Dispersion 16 % Salt _____
Other: _____

Specifications:
Specimen: Height _____ Size < #4 Diameter 1.5" Material
Max. ☒ Consolidated ☐ Drained ☐ Unconsolidated ☒ Undrained

☒ Undisturbed and Tested at: ☐ Natural Moisture ☒ Saturation
☐ Remolded and Tested at: ___ % of ☐ Standard ☐ Modified
with w = _____ % which is
☐ Lower than Optimum ☐ Optimum ☐ Higher than Optimum ☐ Saturated

Test Data

Initial Dry Density gm/cc pcf	Final Dry Density gm/cc pcf	Moisture Content Start %	% Sat. Start	Moisture Content End %	Lateral Pressure σ_3	Consolidation Data Orig. e_0	Consolidation Data Final e_f	Stress at Failure $\sigma_1 - \sigma_3$	% Strain at Failure ε	Internal Friction ϕ Tan ϕ	Unit Cohesion
1.55	1.59	26.8	99.6	25.3	10	0.7161	0.6730	24.9	4	ϕ 21°	42 psi
1.55	1.61	26.9	100.0	24.6	20	0.7161	0.6522	34.2	4		600 psf
1.53	1.61	26.9	96.8	23.8	30	0.7255	0.6522	45.3	10	Tan ϕ	



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

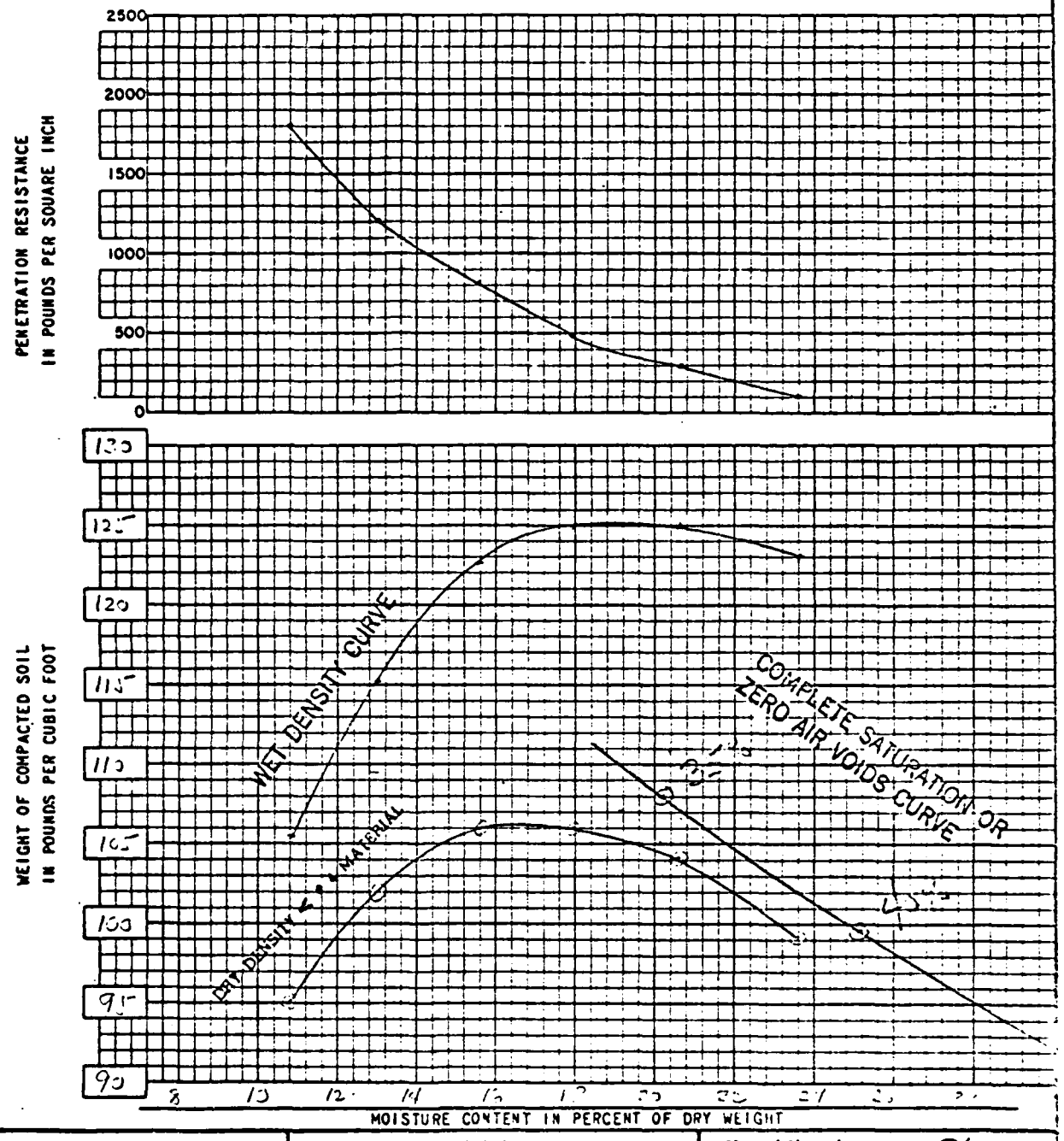
SCS-352 Rev. (10/58)

COMPACTION AND PENETRATION RESISTANCE REPORT

Date _____ Sample No.: Field + Lab 63W3612

Project 102 RIVER TRIBUTARIES "C-3 Location MISSOURI

Sample Location and Depth + COMPOSITE DEPTH 1-6'



TYPE OF TEST	TEST PROCEDURE	
☒ Standard Proctor	Weight of Hammer 5.5 Lbs.	Classification CL
☐ Modified AASHO	Drop 12 Inches	Material compacted represents 100 percent of the sample and passed #4 sieve
☐ Other _____	Lifts 3	(Sp. Gr.) Gs= 2.66
	Vol. of Cylinder 1/30 Cu.Ft.	Curve 1 of 1

58M-26

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

SCS-352 Rev. (10/58)

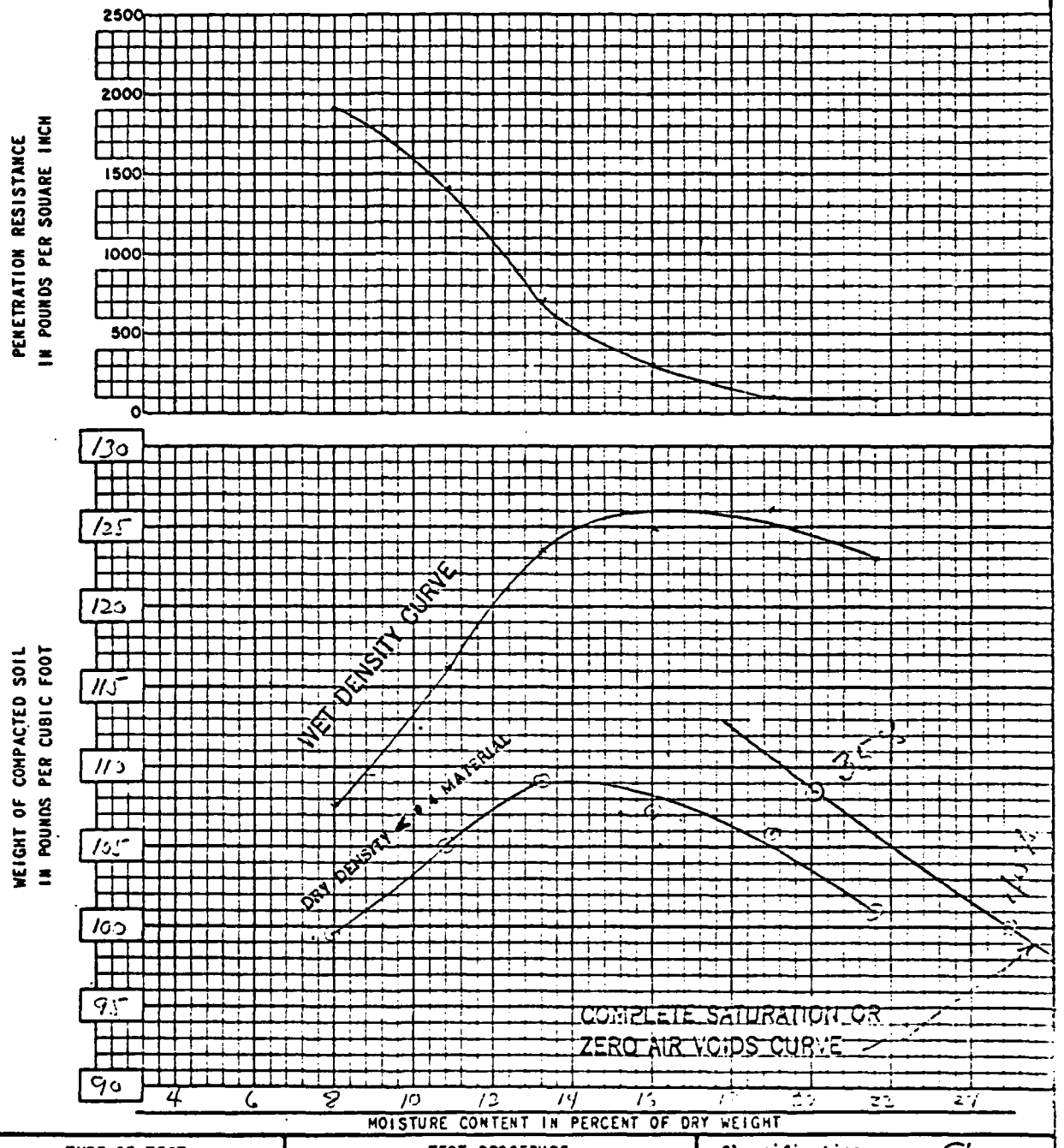
COMPACTION AND PENETRATION RESISTANCE REPORT

Date _____ Sample No.: Field * Lab 63UJ3614

Project 102 RIVER TRIBUTARIES #C-2 Location MISSOURI

Sample Location and Depth

* COMPOSITE DEPTH 6-12'



TYPE OF TEST	TEST PROCEDURE	
☒ Standard Proctor	Weight of Hammer 5.5 Lbs.	Classification CL
☐ Modified AASHO	Drop 12 Inches	Material compacted represents 100 percent of the sample and passed #4 sieve
☐ Other _____	Lifts 3	(Sp. Gr.) Gs= 2.67
	Vol. of Cylinder 1/30 Cu.Ft.	Curve 2 of 7

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SCS-352 Rev. (10/58)

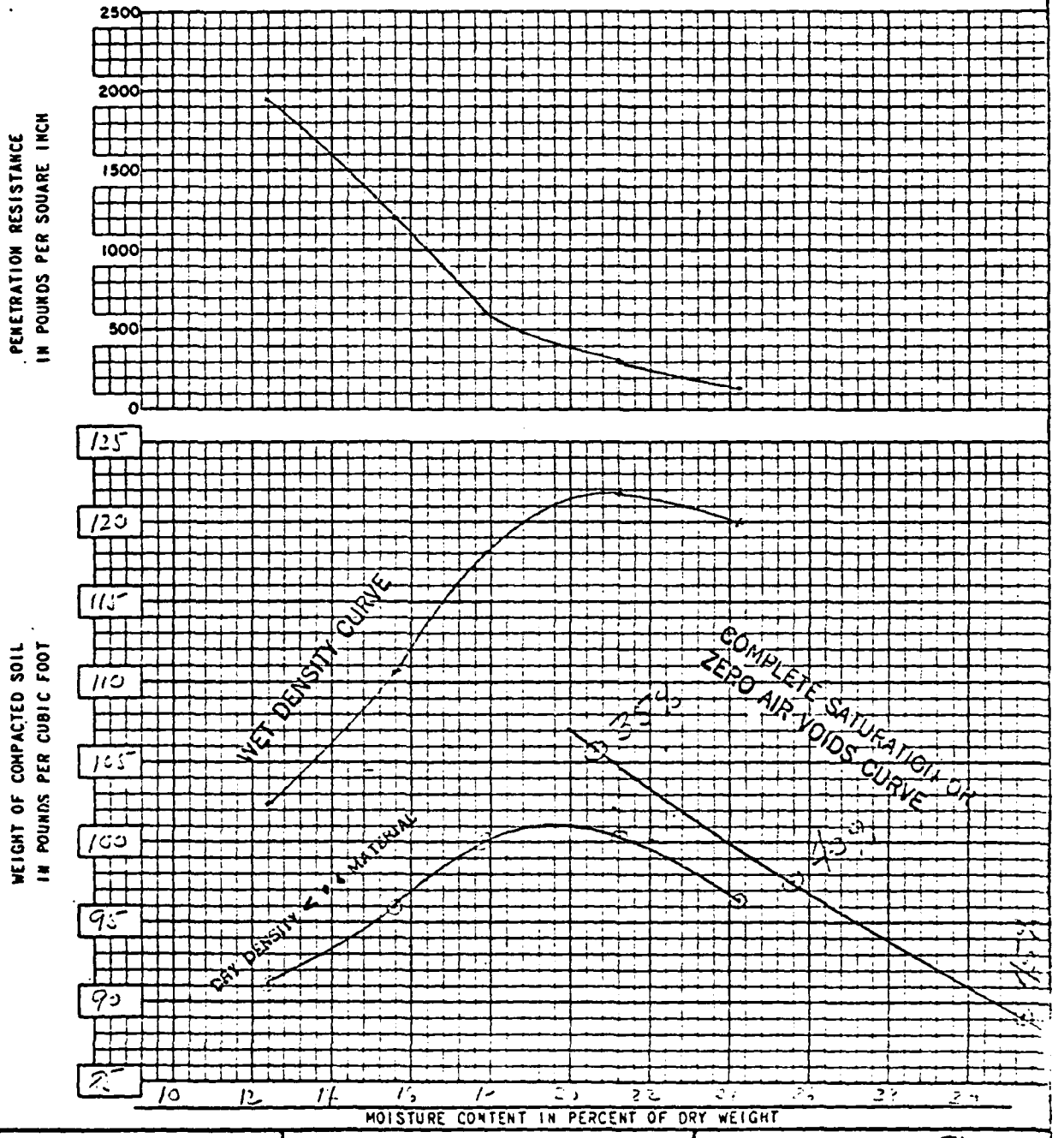
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

COMPACTION AND PENETRATION RESISTANCE REPORT

Date _____ Sample No.: Field 104-1 Lab 63W3615

Project 102 RIVER TRIBUTARIES - C-3 Location MISSOURI

Sample Location and Depth Borrow D+30 7+60 Depth 1-7'



TYPE OF TEST	TEST PROCEDURE	
☒ Standard Proctor	Weight of Hammer 5.5 Lbs.	Classification CL
☐ Modified AASHO	Drop 12 Inches	Material compacted represents 100 percent of the sample and passed #4 sieve
☐ Other _____	Lifts 3	(Sp. Gr.) Gs= 2.61
	Vol. of Cylinder 1/30 Cu.Ft.	Curve 3 of 7

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SCS-352 Rev. (10/58)

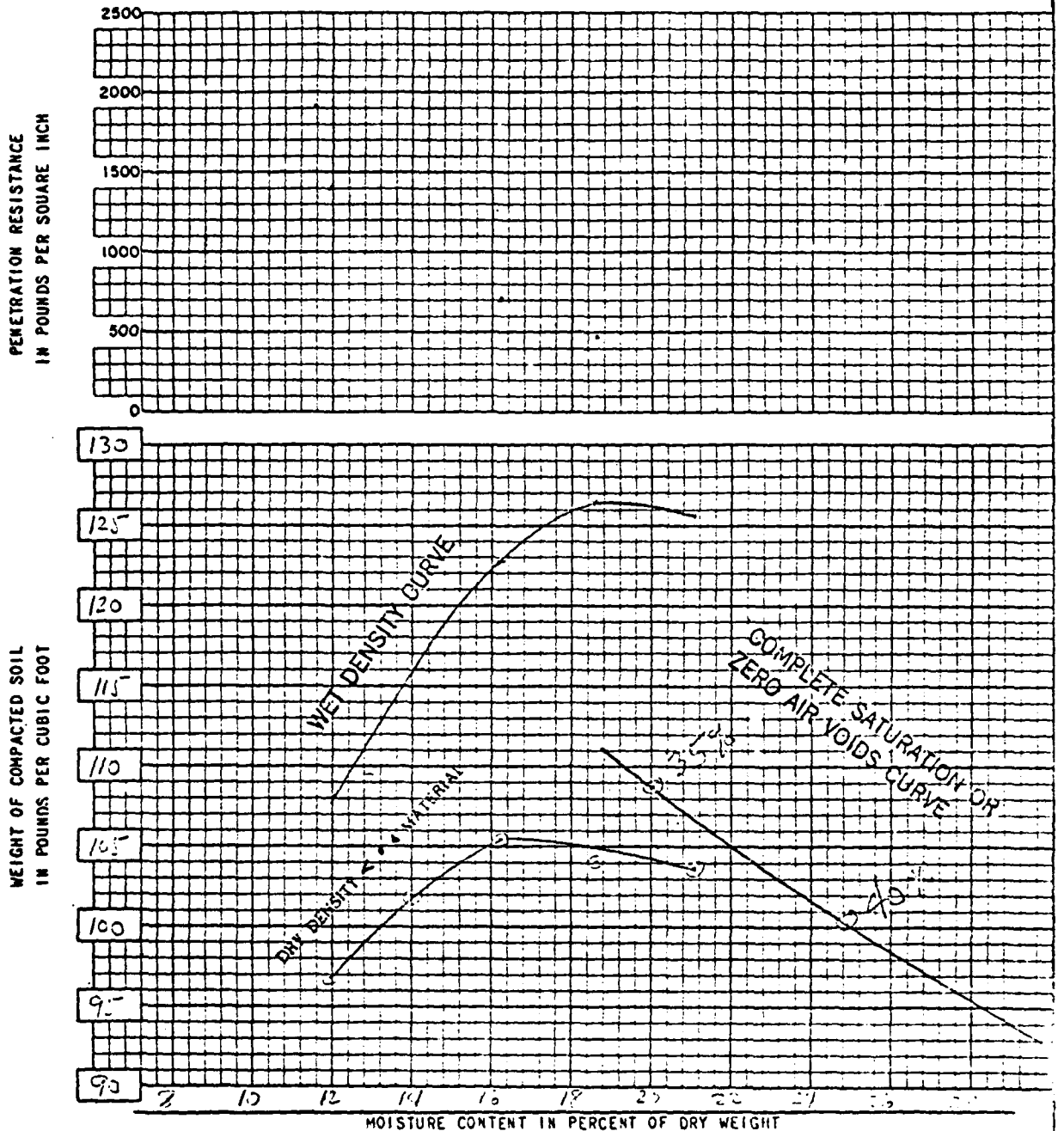
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

COMPACTION AND PENETRATION RESISTANCE REPORT

Date _____ Sample No.: Field 105-1 Lab 630J3616

Project 103 RIVER TRIBUTARIES "C-3" Location MISSOURI

Sample Location and Depth Borrow Stas 6+00 6+00 Depth 0-4'



TYPE OF TEST	TEST PROCEDURE	
☒ Standard Proctor	Weight of Hammer 5.5 Lbs.	Classification CL
☐ Modified AASHO	Drop 12 Inches	Material compacted represents 100 percent of the sample and passed #4 sieve
☐ Other _____	Lifts 3	(Sp. Gr.) Gs= 2.68
	Vol. of Cylinder 1/30 Cu.Ft.	Curve 4 of 7

58M-26

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

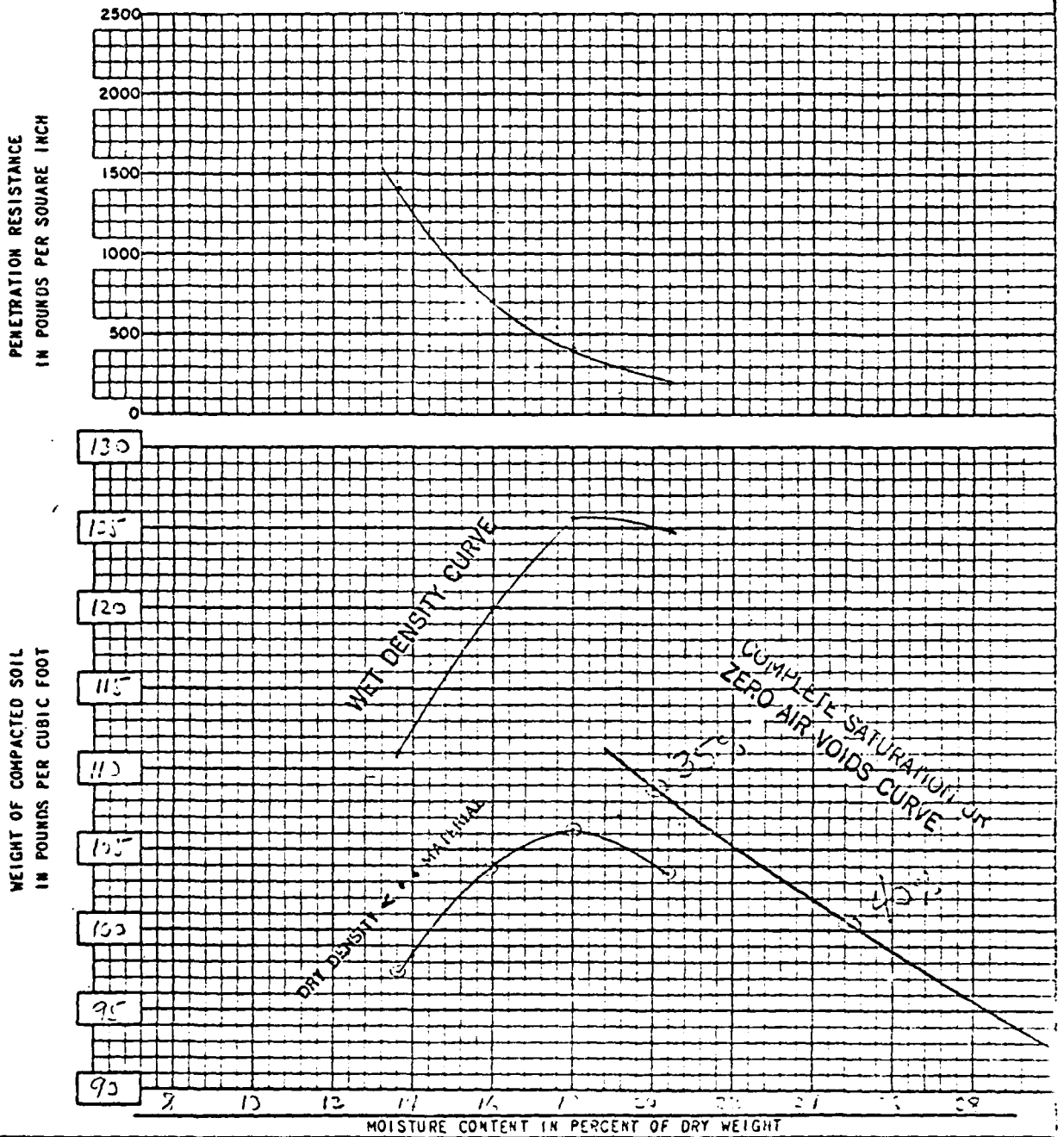
SCS-352 Rev. (10/58)

COMPACTION AND PENETRATION RESISTANCE REPORT

Date _____ Sample No.: Field 105-2 Lab 63UJ3617

Project 102 RIVER TRIBUTARIES #C-3 Location MISSOURI

Sample Location and Depth BORING G+00 6+00 DEPTH 4-12'



TYPE OF TEST	TEST PROCEDURE	
☒ Standard Proctor	Weight of Hammer 5.5 Lbs.	Classification CL
☐ Modified AASHO	Drop 12 Inches	Material compacted represents 100 percent of the sample and passed #4 sieve
☐ Other _____	Lifts 3	(Sp. Gr.) Gs= 2.68
	Vol. of Cylinder 1/30 Cu.Ft.	Curve 5 of 7

58M-26

SCS-352 Rev. (10/58)

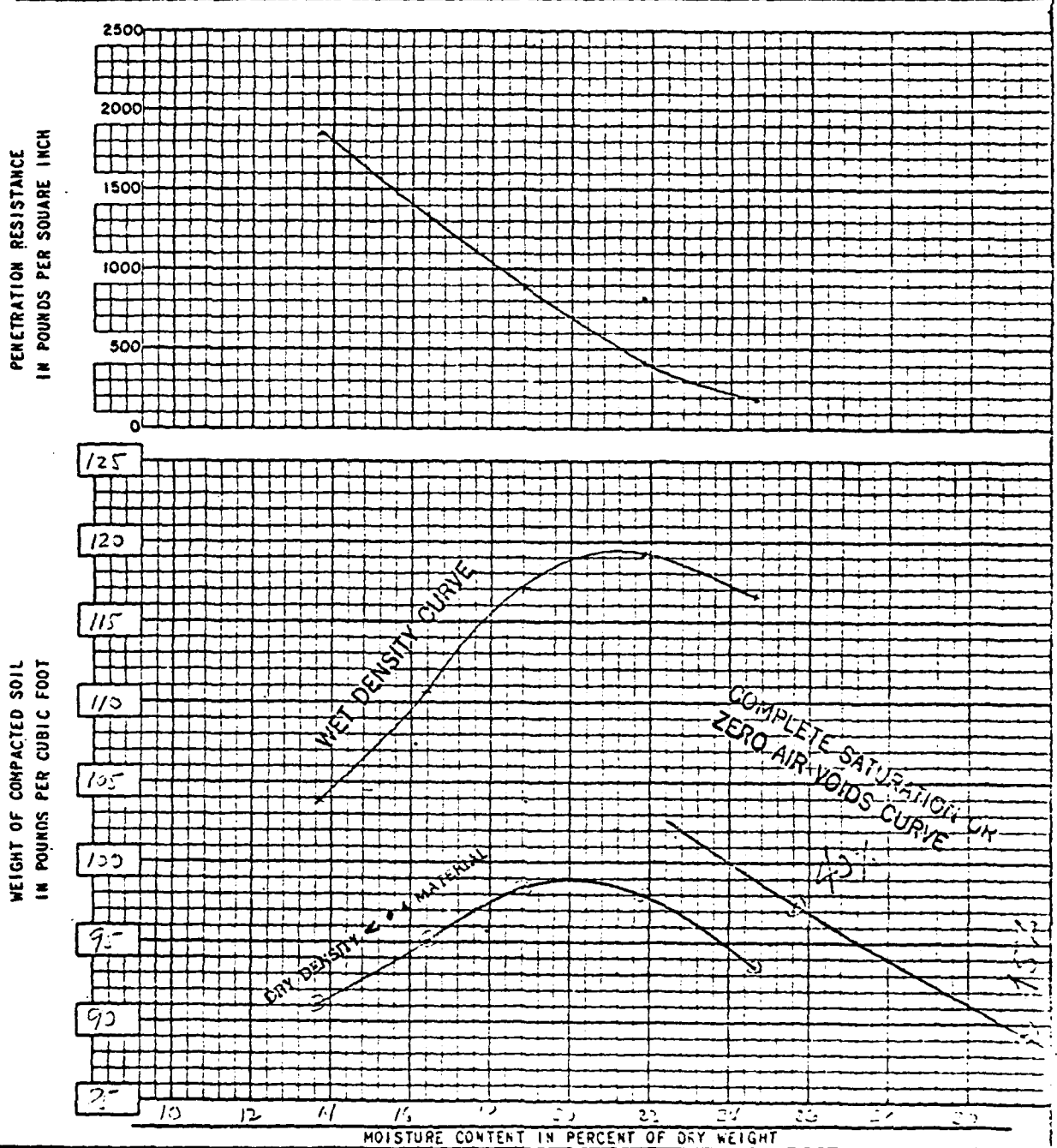
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

COMPACTION AND PENETRATION RESISTANCE REPORT

Date _____ Sample No.: Field 106-1 Lab 63U33618

Project MO RIVER TRIBUTARIES "C-3" Location MISSOURI

Sample Location and Depth BORING H+00 R+00 DEPTH 0-3'



TYPE OF TEST	TEST PROCEDURE	
☒ Standard Proctor	Weight of Hammer 5.5 Lbs.	Classification CL
☐ Modified AASHO	Drop 12 Inches	Material compacted represents 100 percent of the sample and passed #4 sieve
☐ Other _____	Lifts 3	(Sp. Gr.) Gs= 2.59
	Vol. of Cylinder 1/30 Cu.Ft.	Curve 6 of 7

58M-26

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
SOIL MECHANICS LABORATORY

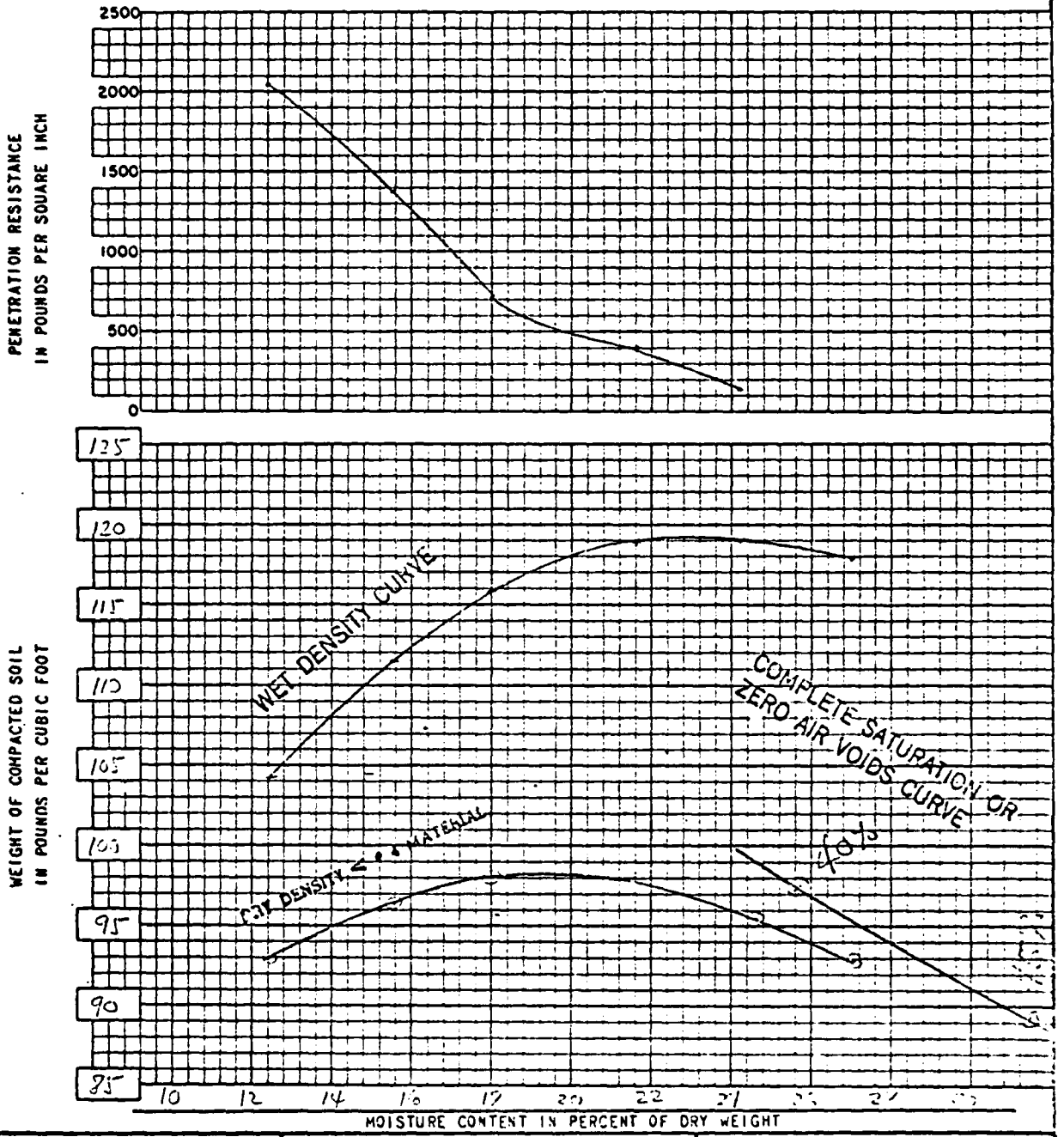
SCS-352 Rev. (10/58)

COMPACTION AND PENETRATION RESISTANCE REPORT

Date _____ Sample No.: Field 106-2 Lab 63U3619

Project 102 RIVER TRIBUTARIES - C-3 Location MISSOURI

Sample Location and Depth BORING H+00 9+00 DEPTH 3-4'



TYPE OF TEST	TEST PROCEDURE	
☒ Standard Proctor	Weight of Hammer 5.5 Lbs.	Classification CL
☐ Modified AASHO	Drop 12 Inches	Material compacted represents 100 percent of the sample and passed #4 sieve
☐ Other _____	Lifts 3	(Sp. Gr.) Gs= 2.62
	Vol. of Cylinder 1/30 Cu.Ft.	Curve 7 of 7

58M-26

FORM SCS-357
10-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State MISSOURI Project 102 RIVER TRIBUTARIES #C-3

Date 6-7-63 Analysis Made By G.L.M. Checked By G.N.G.

Method of Analysis Swedish Circle

Location of Material	Found CL		Found CH		Found CL		Emb 95% Std. CL			
Sample No.	63W2501		63W2878		63W3598		63W3613			
γ_d	95.2		96.4		88.8		107.7			
γ_m							117.5			
γ_s	121.5		122.5		117.5		125.5			
γ_b	59.0		60.0		55.0		63.0			
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ		16.5°		21.0°		16.0°		8.5°		
Tan ϕ		0.296		0.384		0.287		0.149		
K										
C		175		600		500		650		

UPSTREAM SLOPE

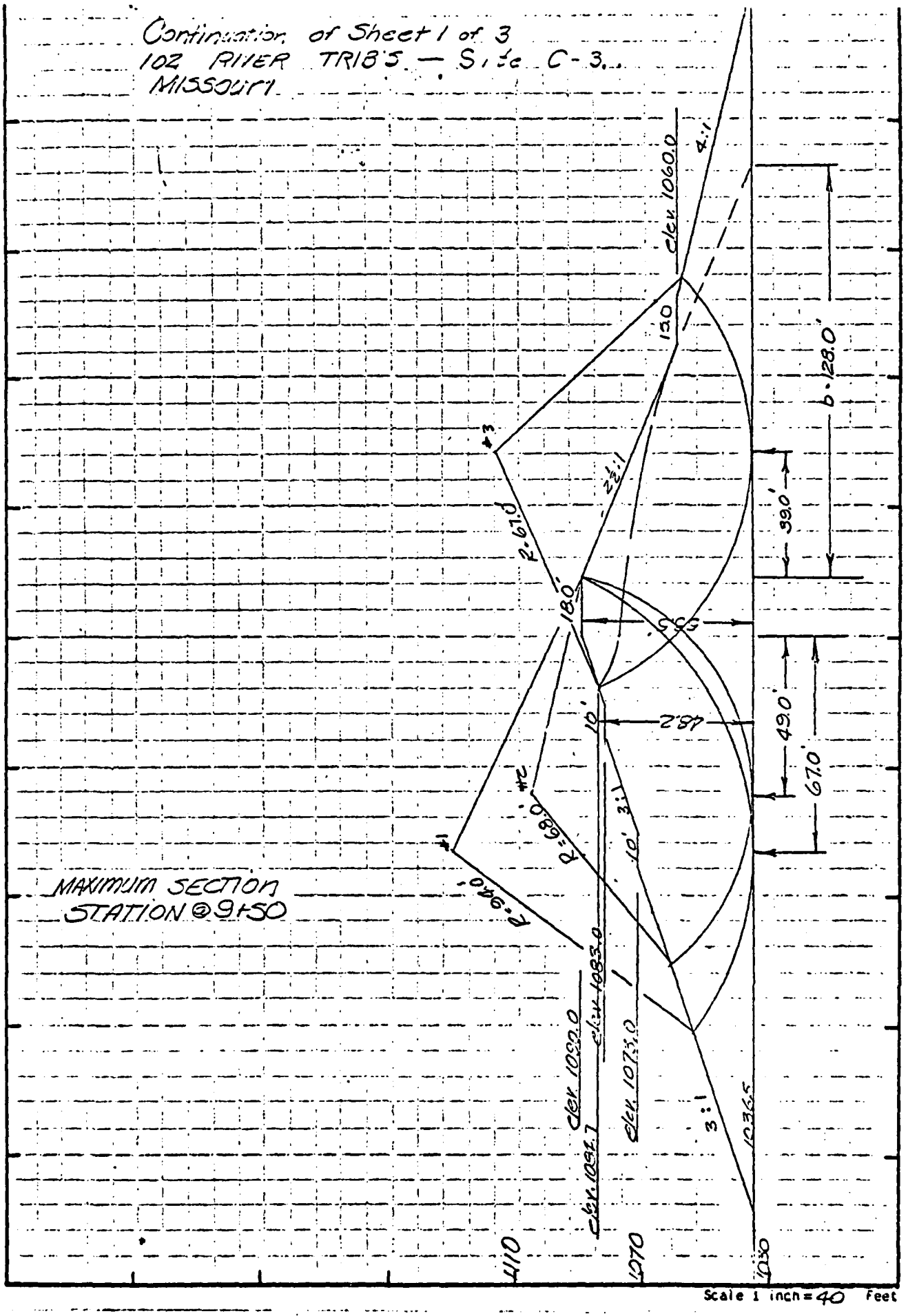
Trial	Slope	Conditions	Fs
1	3:1	Full drawdown - 10' berm @ elev 1093.0 - 100'	
		berm @ elev 1073.0. Arc cut from top	
		shoulder thru Emb 63W3613 only Sat.	
		shear values only.	1.49
2	3:1	Same as #1 but Tangent Point moved downstream	
		120'	1.70

DOWNSTREAM SLOPE

Trial	Slope	Conditions	Fs
3	3:1	Full drawdown - 15' berm @ elev 1060.0. Arc	
		cut from top shoulder thru Emb 63W3613	
		only Sat. shear values only	1.47

To be used to report to field offices data used for slope stability analyses and the results of the analyses. The right side of the form will be used for a sketch of the embankment on which the analyses have been made.

GPO : 1959 O - 469388


Continuation of Sheet 1 of 3
102 RIVER TRIBS. — Sec C-3
MISSOURI
MAXIMUM SECTION
STATION @ 9+50
elev 1060.0
4:1
130
b. 128.0
+3
2:1
R=67.0'
180'
39.0'
10'
2:1
49.0'
67.0'
+1
R=99.0'
10' 3:1
R=90.0'
elev 1032.0
elev 1052.7
elev 1083.0
elev 1073.0
3:1
1110
1070
1030
Scale 1 inch = 40 Feet

FORM SCS-357
10-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY

SUMMARY. - SLOPE STABILITY ANALYSIS

State MISSOURI Project 102 RIVER TRIBUTARIES # C-3

Date 6-10-63 Analysis Made By G.L.M. Checked By G.M.G.

Method of Analysis SWEDISH CIRCLE

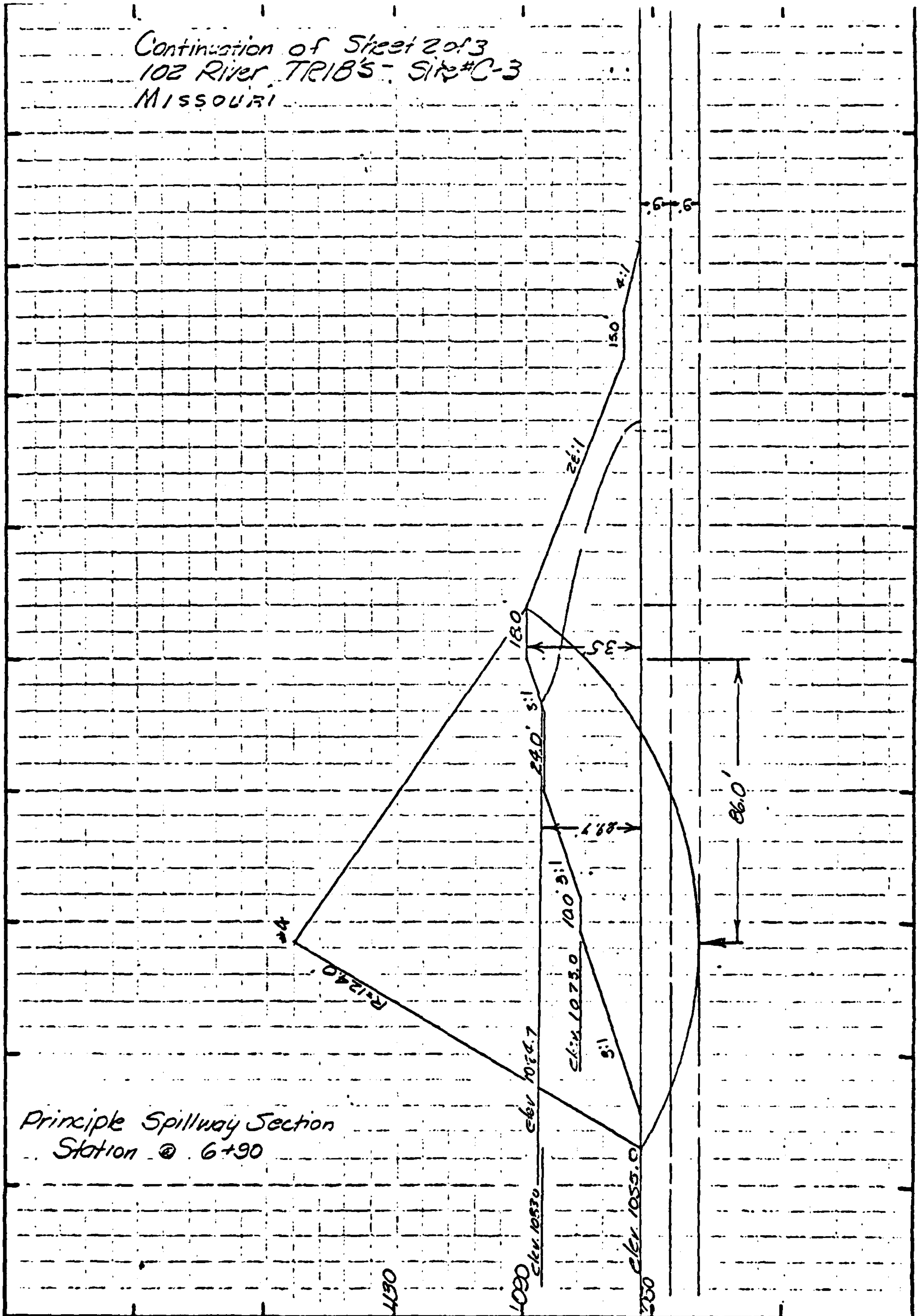
To be used to report to field offices data used for slope stability analyses and the results of the analyses. The right side of the form will be used for a sketch of the embankment on which the analyses have been made.

Location of Material										
Sample No.		See sheet 1 of 3 for Mat'ls.								
γ_d										
γ_m										
γ_s										
γ_b										
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ										
Tan ϕ										
K										
C										

UPSTREAM SLOPE			
Trial	Slope	Conditions	Fs
4	3:1	Full drawdown - 10.0 berm @ elev 1072.0 & 240' berm @ elev 1053.0. Arc cut from 2nd. slide thru Emb. 63W3613 S 180° Zoned Found. Sat. shear values only.	1.38
		Note: Zoning 0'-9' of 63W3524 9'-18' of 63W3524	

DOWNSTREAM SLOPE			
Trial	Slope	Conditions	Fs

Continuation of Sheet 2 of 3
102 River TRIB'S - Site #C-3
MISSOURI



Principle Spillway Section
Station @ 6+90

Scale 1 inch = 40 Feet

FORM SCS-357
10-58

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL MECHANICS LABORATORY

SUMMARY - SLOPE STABILITY ANALYSIS

State *MISSOURI* Project *102 RIVER TRIBUTARIES #C-3*

Date ______ Analysis Made By *GLM & TCH & CWS* Checked By *GWS & GLM*

Method of Analysis *SWEDISH CIRCLE*

Location of Material										
Sample No.	*See sheet 1 of 3 for Mat'ls*									
γ_d										
γ_m										
γ_s										
γ_b										
Condition	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.	Opt.	Sat.
ϕ										
Tan ϕ										
K										
C										

UPSTREAM SLOPE

Trial	Slope	Conditions	Fs
5	3:1	Full drawdown - 23.0' berm @ elev. 1053.0 & 10.0' berm @ elev. 1073.0.	
		Arc cut from [illegible] thru Emb. 63W[illegible] & 21.0'* Zoned	
		Found. Sat. shear values only	1.25
5A	3:1	Same as #5 but 20.0' berm @ elev. 1060.0	1.45
6	3:1	Same as #5 but Tangent Point moved downstream 14.0'.	1.35
7	3:1	Same as #5A but Tangent Point moved upstream 20.0'.	1.34
8	3:1	Same as #5 but 10.0' berm @ elev. 1053.0 & elev. 1073.0.	1.12
8A	3:1	Same as #8 but 30.0' berm @ elev. 1060.0.	1.35
9	3:1	Same as #8 but Tangent Point moved upstream	
		20.0'	1.34

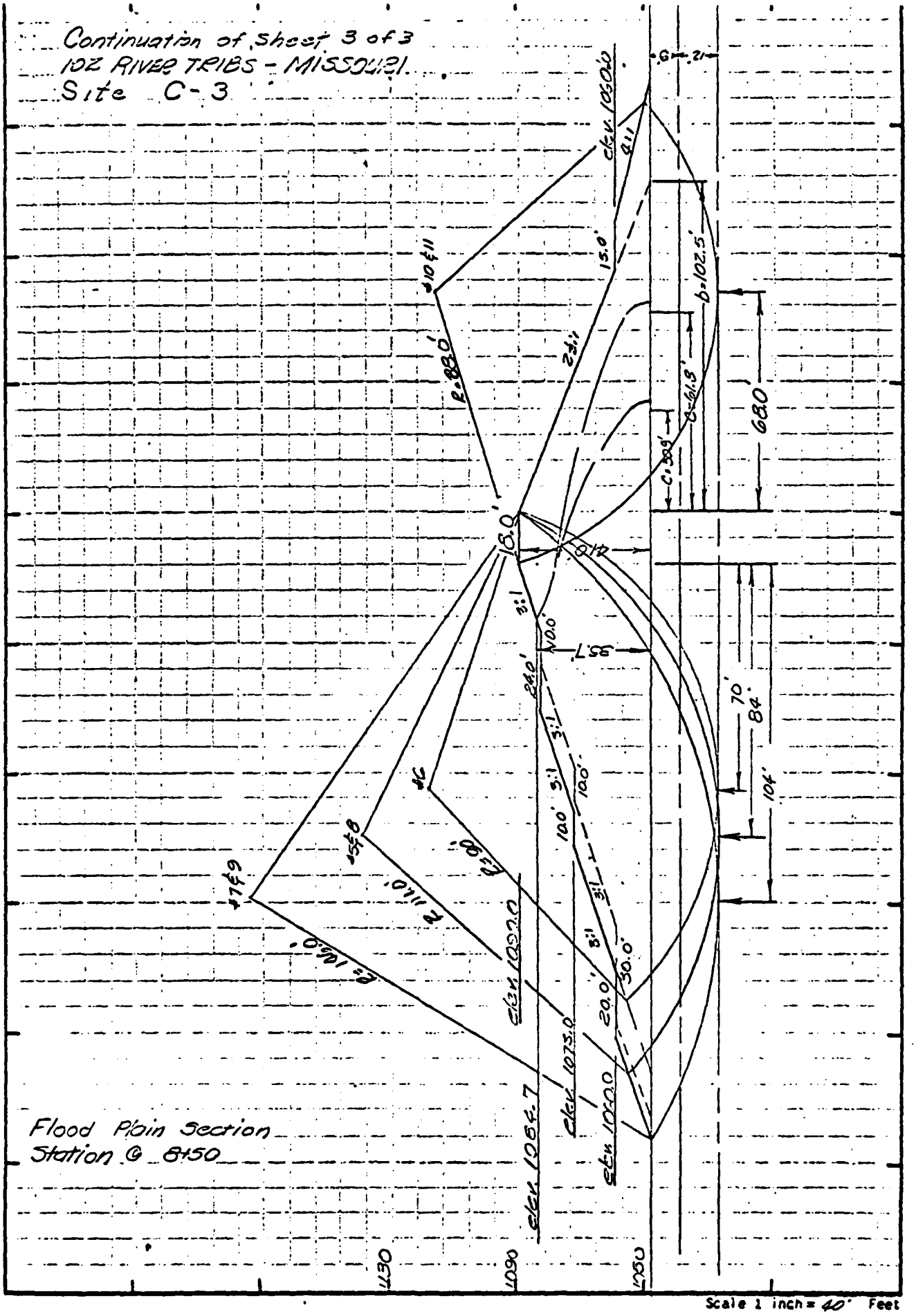
DOWNSTREAM SLOPE

Trial	Slope	Conditions	Fs
10	3:1	Drain @ [illegible] = 0.3 - 15.0' berm @ elev. 1050.0. Arc cut from	
		[illegible] thru Emb. 63W[illegible] & 21.0'* Zoned Found.	
		Sat. shear values only.	1.43
11	2½:1	Same as #10.0 but drain @ [illegible] = 0.6	1.24
		* Found Zoning = 0'-9' - 21.0° - 600	
		9'-21' = 16.5° - 175	

To be used to report to field offices data used for slope stability analyses and the results of the analyses.
The right side of the form will be used for a sketch of the embankment on which the analyses have been made.

GPO : 1959 O - [illegible]

Continuation of Sheet 3 of 3
IOZ RIVER TRIBS - MISSOURI
Site C-3



Flood Plain Section
Station @ 8+50

APPENDIX D
HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. The Mockes dimensionless standard curvalinear unit hydrograph and the SCS TR-20 program were used to develop the inflow hydrographs (see Plate D1). The inflow hydrograph for the 100-year flood is taken from design computations furnished by the SCS on their plans. However, a 100-year storm inflow was generated by the consultant using the TR-20 program and it compared closely in regards to peak and shape.

a. Six-hour, 100-year rainfall for the dam location was taken from NOAH Technical Paper 40, which compared closely with the furnished SCS value. The 24-hour probable maximum precipitation was taken from the curves of Hydrometeorological Report No. 33 and current OCE directives furnished 3 August 1978.

b. Drainage area = 1.14 square miles.

c. Time of concentration of runoff = 25 minutes.

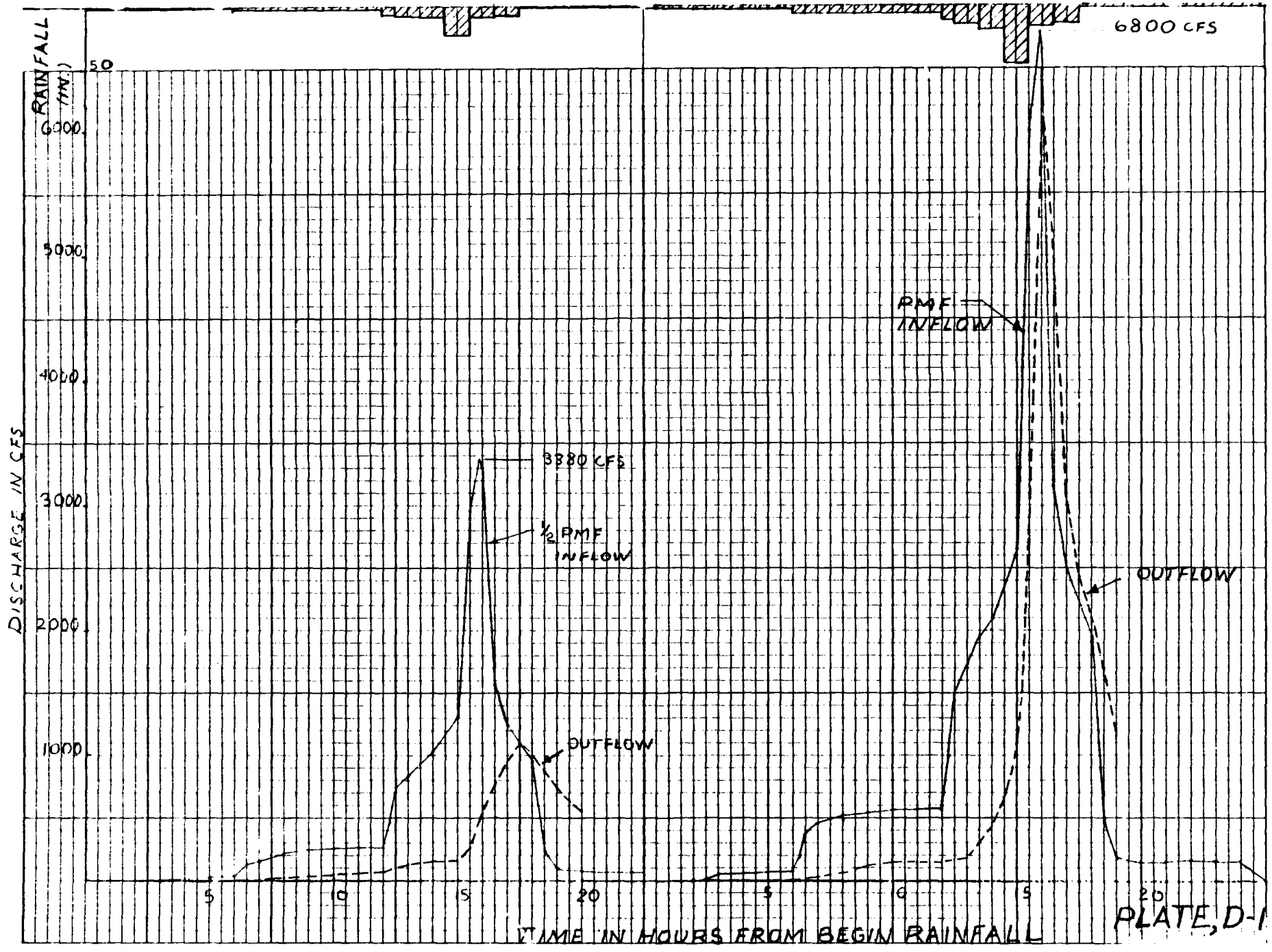
d. The antecedent storm conditions were heavy rainfall and low temperatures which occurred on the previous 5 days (SCS AMCIII). The initial pool elevation was assumed at the crest of the principal spillway.

e. The total six-hour storm duration losses for the 100-year storm were 0.92 inches (SCS) which is a 0.23 PMF storm. The total losses for the 24-hour duration 1/2 PMF storm were 1.2 inches. The total losses for the PMF storm were 1.3 inches. These data are based on SCS runoff curve No. 90 and antecedent moisture conditions from SCS AMCIII.

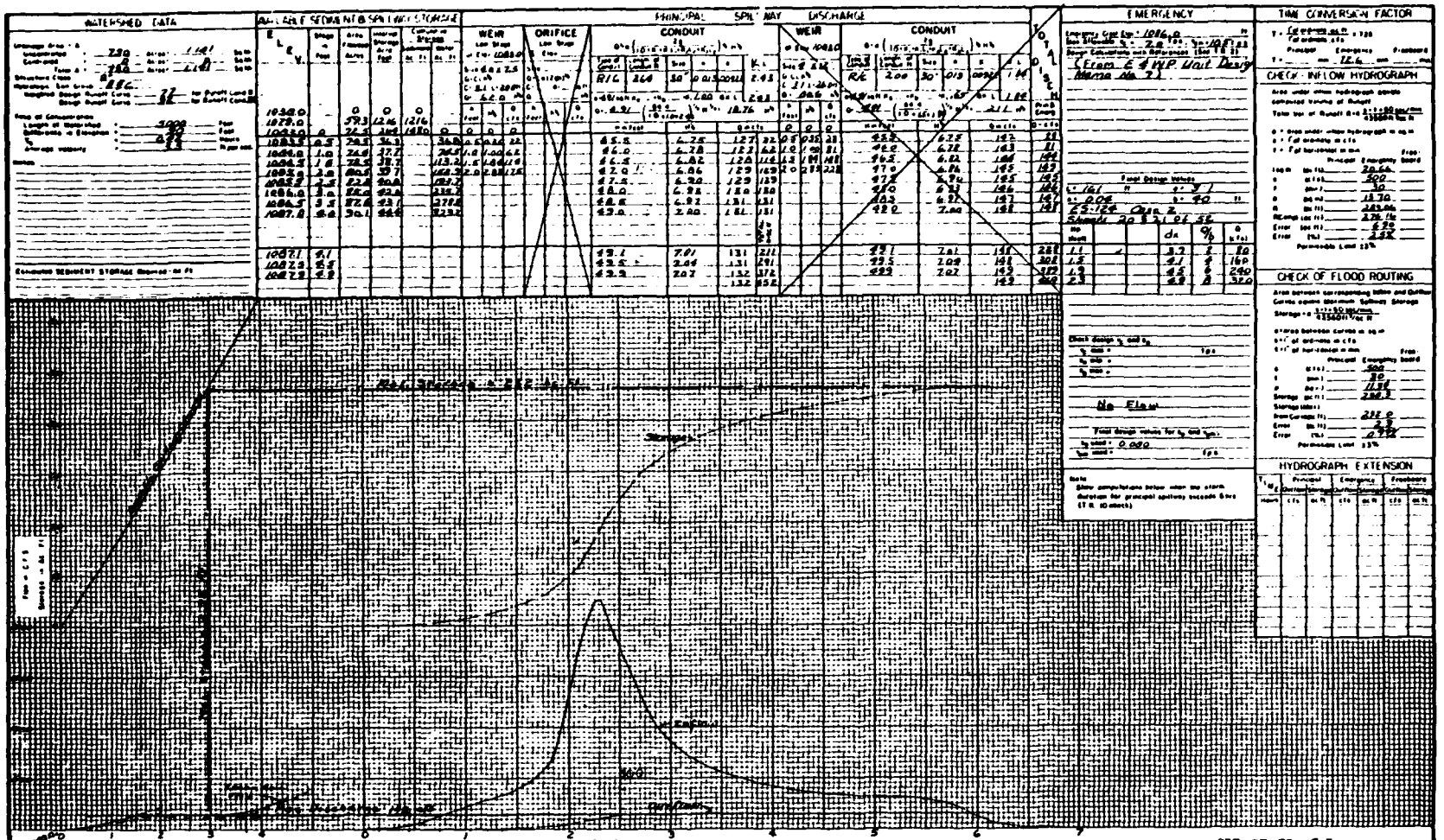
f. Average soil loss rates = 0.05 inch per hour approximately.

2. Combined spillway discharge ratings used were SCS design computations (sheet 1 of 4 E-20552-H) for the principal spillway. The emergency spillway rating was developed by extending the SCS design computations. This was done using the concept of critical depth in the spillway control section and conservative head losses through the spillway entrance section (head loss = 0.25 Hv), where Hv is the velocity head at the spillway control section. These computations were compared using the SCS design computer program for rating and routing earth channel emergency spillways. The results compared reasonably. The flows over the dam crest are based on the broad crested weir equation ($Q = CLH^{3/2}$), where H is the head on the dam crest; the coefficient C, which varies with head, is taken from the USGS publication "Measurement of Peak Discharge at Dams by Indirect Methods: Book 3, Chapter 5, TWRI".

3. Floods were routed through the spillway using the TR-20 program to determine capability of the spillway and dam embankment crest. The storm rainfall patterns, inflow hydrographs and routed outflow hydrographs are given on Plate D1.



PLATE, D-1



STRUCTURE C-3

FLOOD ROUTING

EMERGENCY SPILLWAY HYDROGRAPH

102 RIVER TRIBUTARIES WATERSHED PL 566

NODAWAY COUNTY MISSOURI

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

S-C-20668-N